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Estimates of Sulfur Oxide Emissions from the Electric Utility Industry. Volume I Summary and Analysis

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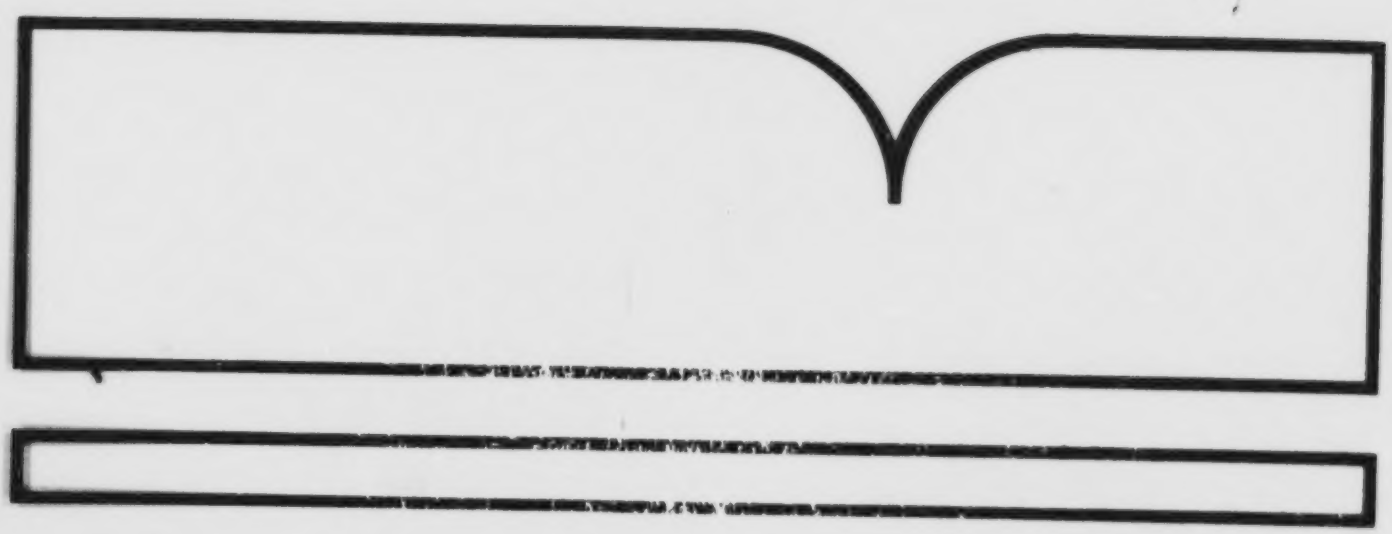

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ESTIMATES OF SULFUR OXIDE EMISSIONS FROM THE ELECTRIC UTILITY INDUSTRY

VOLUME I - SUMMARY AND ANALYSIS

by

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16. ABSTRACT

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Volume I presents a summary of fuel use and emissions information as well as results of analyses of the data. Volume II presents selected statistics for the 237 plants which were the largest emitters of SO_x during the 1976-1980 period.

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SECTION I

INTRODUCTION

A. PURPOSE

The purpose of this report is to provide detailed and definitive information on emissions of sulfur oxides into the atmosphere from generating plants operated by the electric utility industry over the period from 1976 through 1980. To provide the needed information, a detailed database at the individual plant level of detail was used. Analyses based on this database are presented here at the plant level. These analyses also are aggregated to state or national totals.

The major products of this study are the database developed for this report and the analyses provided and presented here. In addition to sulfur oxide emissions, the database contains power generation statistics and information on quantity and quality of fuels used. Appendix A describes the contents of this database.

This is Volume I of a two-volume report. In this volume, summary information and analytical results are presented. The companion volume, Volume II, is a data report that contains selected statistics for the 237 plants that emitted the most sulfur oxides over the period 1976 through 1980. An example of the information contained in Volume II is presented in Appendix B.

B. BACKGROUND

Sulfur dioxide (SO_2) is one of the seven pollutants for which national ambient air quality standards have been promulgated. These standards are designed to limit ground level concentrations of SO_2. More recently, a number of studies have linked emissions of sulfur oxides to elevated levels of acid deposition, thus increasing the interest in understanding emission quantities and distribution patterns of sulfur oxides. In the United States, the electric utility industry is responsible for approximately two-thirds of sulfur oxide emissions.[1]

Two research needs have been identified in this connection. The first concerns emissions from the electric utility industry of SO_2 and other possible precursors of acidic deposition. The second research need is to quantify the effects on the industry of possible actions to alter emission quantities and/or patterns. Thus, the U.S. Environmental Protection Agency (EPA) has initiated the Electric Utility Analysis Project (EUAP). The EUAP is a cooperative agreement between EPA and the University of Illinois at Urbana-Champaign, with E.H. Pechan and Associates, Inc. (EHPA) as the principal subcontractor.

This is the first of a series of reports to be produced as part of the EUAP. One major project activity is the development of a comprehensive Electric Utility Analysis Database. The information presented here is derived

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[1] Throughout this report, what we refer to as sulfur dioxide or SO_2 emissions are actually total sulfur emissions expressed as SO_2. While the vast majority of sulfur emitted to the atmosphere from utility plants is emitted as SO_2, small amounts are emitted as sulfate (SO_4) or other sulfur compounds. The relative share of sulfur emitted as sulfate differs by source. Additional research is under way to better characterize these emissions.

from the Utility Fuel Quality and Use Database, a major component of this data system.

C. SCOPE OF ANALYSIS

The scope of our analysis essentially involved the performance of three interrelated tasks, all directed toward the overall objective of providing analyses with the most accurate inventory available of sulfur oxide emissions from the electric utility industry in the United States.

The three tasks were:

1. Develop as accurate an estimate as possible of emissions from the electric utility industry for the base year of 1980.

2. Conduct analyses of the emission estimates for the years 1976 through 1979 to permit further comparison with the 1980 data.

3. Compare the results from task 1 with other available estimates. Included among these other estimates are (1) the "AIRTEST 80" estimate developed by Teknekron Research, Inc., and modified by EHPA, (2) estimates reported by the utilities themselves to the Department of Energy, and (3) estimates maintained as part of the National Emissions Data System (NEDS) by the Environmental Protection Agency. The AIRTEST estimate generally has been considered to be the best available base case utility emissions estimate. It has been used as part of the "unified inventory" developed by the U.S. and Canadian working groups that, since August 1980, have been examining transboundary air

pollution issues, including acid rain, under a Memorandum of Intent between the two governments.

D. SUMMARY OF RESULTS

In this section, a brief overview of the major results of our analysis is presented. Section III contains a more detailed discussion.

1. The analyses of yearly SO_2 emissions from 1976 to 1980 show a gradual reduction in emissions from the utility industry of about 7.7 percent over the full period. As shown in Table I-1, this reduction was due both to reductions in the sulfur content of coals used by the industry and to the increased use of flue gas desulfurization ("scrubber") systems. These reductions amounted to 1.1 million tons from the

Table I-1

SUMMARY OF CHANGES IN UTILITY SO_2 EMISSIONS FROM 1976 TO 1980
(1000 tons)

	Coal-Related Emissions	Oil-Related Emissions
1976 Emissions	17,065	1,755
Difference Due to Change in Quantity of Fuel Used	929	-430
Difference Due to Change in Fuel Sulfur Content	-1,113	185
Difference Due to Increased SO_2 Scrubbing	-1,013	0
1980 Emissions	15,868	1,510

levels that would have occurred had coal sulfur contents not changed from 1976, and 1.0 million tons due to operation of more SO_2 scrubber systems. Growth in quantities of coal use accounted for an increase of 0.9 million tons, almost as much as either of the two decreasing factors. Oil-related emissions showed a net decrease due to a significant decline in oil use. The decline (430,000 tons) overshadowed the increase (185,000 tons) that occurred due to the use, on the average, of higher sulfur oils. The increase in natural gas use by the industry had no noticeable effect on SO_2 emissions, since natural gas combustion produces almost no SO_2.

Another illustration of these trends is presented in Table I-2, which compares total utility fossil fuel use by fuel type and SO_2 emissions from these fuels by totals and per million Btu heat input. Again, the dominance of coal as a source of utility SO_2 emissions is apparent. Average sulfur content of coal and oil used by the industry is presented in Table I-3.

Almost all of the reductions indicated in Table I-1 occurred in the states with the highest SO_2 emissions. As Table I-4 indicates, essentially all of the net reduction for the nation occurred in the 15 states with the highest utility emissions in 1980. The set of major SO_2 emitting states, however, remained fairly constant between 1976 and 1980. For example, 8 of the 10 highest emitting states in 1980 were also among the highest emitting states in 1976. Michigan and Alabama, ranked ninth and tenth in 1976, were replaced by Georgia and Florida in 1980. The set of states comprising the 15 highest

Table I-2

NATIONAL UTILITY SO_2 EMISSIONS AND HEAT VALUE OF FUELS USED

	1976	1980	% Change 1976-1980
Total SO_2 Emissions (million tons)	18.8	17.4	-7.7
Total Heat Value Used (quads)	16.3	18.8	15
Coal	9.7	12.2	26
Oil	3.4	2.6	-24
Gas	3.1	4.0	29
Net SO_2 Emissions As Pounds/Million Btu			
All Fuels	2.3	1.9	-17
Coal	3.5	2.6	-26
Oil	1.0	1.2	20
Gas	<.01	<.01	0

Table I-3

NATIONAL AVERAGE SULFUR CONTENT OF FUELS USED
BY THE UTILITY INDUSTRY

Year	Coal Sulfur (%)	Coal SO_2 Content (lbs/MMBtu)	Oil Sulfur (%)
1976	2.12	3.91	.96
1977	2.01	3.74	.91
1978	1.86	3.50	.96
1979	1.80	3.36	1.02
1980	1.68	3.15	1.04

emitting states did not change from 1976 to 1980. The share of total emissions contributed by the 15 highest states declined slightly over the period, falling from 86 percent in 1976 to 83 percent in 1980.

Table I-4 also shows utility emissions for a 31-state eastern U.S. region which includes all of the states east of the Mississippi River plus the first tier of states west of the Mississippi (Minnesota, Iowa, Missouri, Arkansas, and Louisiana). This region, which has been used in a variety of acid rain-related studies, accounted for 95 percent of national utility SO_2 emissions in 1976 and 92 percent in 1980.

2. A subset of plants with high emissions accounts for a substantial share of industry capacity and coal use. To illustrate this, a subset of plants was developed consisting of the 200 highest SO_2 emit-

Table I-4

TRENDS IN UTILITY SO_2 EMISSIONS 1976-1980 FOR
THE 15 HIGHEST EMITTING STATES (1980) AND THE NATION
(Emissions in 1000 Tons per Year)

1980 Rank	State	1976 Rank	Emissions 1976	1977	1978	1979	1980
1	Ohio	1	2,750	2,686	2,463	2,515	2,172
2	Indiana	3	1,443	1,458	1,351	1,537	1,540
3	Pennsylvania	4	1,432	1,381	1,323	1,415	1,466
4	Missouri	7	1,179	1,202	1,014	1,076	1,141
5	Illinois	5	1,429	1,367	1,293	1,168	1,126
6	Kentucky	2	1,512	1,357	1,210	1,130	1,008
7	West Virginia	8	1,010	1,001	896	956	944
8	Tennessee	6	1,228	1,258	1,033	893	934
9	Georgia	13	499	581	616	666	737
10	Florida	11	673	658	595	659	726
11	Michigan	9	888	905	807	741	565
12	Alabama	10	705	735	531	521	543
13	Wisconsin	14	470	515	472	496	486
14	New York	12	513	549	520	508	480
15	North Carolina	15	410	427	396	380	435
TOTAL OF 15 HIGHEST			16,141	16,080	14,520	14,661	14,303
EASTERN U.S. TOTAL			17,853	17,945	16,472	16,459	16,068
NATIONAL TOTAL			18,821	19,071	17,593	17,685	17,379

ting plants during 1980. As Table I-5 shows, these plants, about 10 percent of plants included in the study,[2] accounted for slightly less than 50 percent of all generating capacity, over 75 percent of all coal used, and over 85 percent of all SO_2 emissions. The coal plants constructed in the last three decades are generally more economically efficient because of their larger size. These plants are used to

Table I-5

SHARES OF 1980 EMISSIONS AND OTHER VARIABLES ATTRIBUTED TO LARGE PLANTS

	All Plants (N=1,878)	200 Highest SO_2 Emitting Plants (N=200)	% of Total in 200 Highest
Total SO_2 Emissions (thousand tons)	17,379	14,984	86
Total Generating Capacity (gigawatts)	477	227	48
Total Generation (terawatt-hours)	1,754	1,027	59
Average Capacity Factor	.42	.52	
Total Coal Used (million tons)	569	438	77
Total Oil Used (million barrels)	420	162	39
Total Gas Used (billion cubic feet)	3,682	1,282	35

[2] All utility generating plants burning at least some coal, oil, or natural gas during the 1976 to 1980 time frame.

generate power a larger fraction of the time, and, without sulfur emission controls, emit a relatively larger amount of SO_2 than comparable oil- and gas-fired plants.

Appendix C contains summary SO_2 estimates for the 200 highest SO_2 emitting plants from three sources: (1) AIRTEST, (2) Form 67 (for 1979), and (3) our own work (for 1976 through 1980).

3. Table I-6 further emphasizes the dominance of coal plants (plants consuming at least some coal) among the set of all plants as well as those in the set of the 200 highest SO_2 emitting plants. The 24 percent of plants burning at least some coal account for over half of all generating capacity and over two-thirds of actual generation. Of the 200 highest emitters, 183 use at least some coal.

4. In developing the information presented here, we conducted extensive comparisons with other recent estimates of SO_2 emissions. Extensive comparisons were made with EPA's National Emissions Data System as well as with the AIRTEST system recently used in the EPA-DOE Acid Rain Mitigation Study. In addition, selected comparisons were made with utility-reported data contained in the Department of Energy's Form 67. Finally, we subjected our draft results to detailed review by the utilities which own the major SO_2 emitting plants. We compared NEDS data with our 1978 estimates because the weighted average year of record on the NEDS data type was closest to 1978. The national differences are relatively small, but the state differences are much larger. This may be due at least in part to different years of record for NEDS data by state since the NEDS system is dependent

Table I-6

SHARES OF 1980 EMISSIONS AND OTHER VARIABLES ATTRIBUTED TO COAL PLANTS

	All Plants (N=1,878)	All Coal Plants (N=457)	Coal Plants Among 200 Highest Emitters (N=183)	Percent of 200 Highest Emitters
Total SO_2 Emissions (thousand tons)	17,379	16,153	14,355	89
Total Generating Capacity (gigawatts)	477	278	209	75
Total Generation (terawatt hours)	1,754	1,223	959	78
Average Capacity Factor	.42	.50	.52	
Total Coal Used (million tons)	569	569	438	77
Total Oil Used (million barrels)	420	70	57	81
Total Gas Used (billion cubic feet)	3,682	239	101	42

upon state data. AIRTEST data were compared with our 1980 figures. Again, the relatively small national differences mask somewhat larger state differences. A summary of the comparison of our estimates with NEDS and AIRTEST is presented in Table I-7. State- and plant-level comparisons are presented later in this report.

5. We conducted sensitivity analyses on two key elements of our analyses, coal sulfur ash retention and capacity utilization of large plants (see Table I-8). These sensitivity analyses, intended to be illustrative rather than comprehensive, show that operating practice

Table I-7

SUMMARY COMPARISON OF UTILITY SO_2 EMISSIONS
FROM THIS REPORT WITH OTHER ESTIMATES

	1978	NEDS	1980	AIRTEST
National Emissions (thousand tons)	17,593	18,255	17,379	17,465
Difference (thousand tons)		662		86
Percent Difference		4		0.5
Maximum State Difference (thousand tons)		251.2		266.3
Average Absolute State Difference (thousand tons)		47.8		35.0
Average Absolute Difference (percent)		29.1		24.2

Table I-8

SUMMARY OF SENSITIVITY ANALYSES RELATED TO
COAL SULFUR ASH RETENTION AND CHANGES IN CAPACITY FACTORS

	1980 SO_2 Emissions (1000 tons)	% of Base 1980 SO_2 Emissions
Base Case	17,379	100
AP-42 Sulfur Retention	17,583	101
Low Capacity Utilization of 200 Highest Emitting Plants (.40 maximum)	13,761	79
High Capacity Utilization of 200 Highest Emitting Plants (.70 minimum)	23,128	133

has a major effect on emissions, while the range of conventional assumptions concerning how much sulfur is retained in ash rather than emitted up the stack is relatively unimportant to overall emissions estimates. The significance of capacity utilization of large plants is further illustrated in Table I-9. An increase in minimum capacity utilization of the 200 highest emitting plants in 1980 from the current average of .53 to a minimum of .70 could increase SO_2 emissions by approximately 5.7 million tons. On the other hand, a decrease in capacity utilization (to a maximum of .40) in the same plants could reduce SO_2 emissions by about 3.6 million tons. Of course, such changes would also affect quantities of fuels used (as discussed later) as well as other aspects of utility operations.

Table I-9

EMISSIONS FROM THE 200 HIGHEST SO_2 EMITTING PLANTS UNDER 1980 CONDITIONS AND IF CAPACITY UTILIZATION WERE CHANGED
(Emissions in 1000 tons)

State	Emissions Under 1980 Operating Conditions	Potential Emissions Assuming Maximum 40% Capacity Factor	% of 1980 Actual	Potential Emissions Assuming Minimum 70% Capacity Factor	% of 1980 Actual
Ohio	2,100	1,600	75	2,900	140
Indiana	1,400	1,100	80	2,000	140
Pennsylvania	1,400	900	65	1,700	120
Missouri	1,000	800	80	1,500	150
Illinois	900	700	80	1,300	145
Kentucky	900	700	80	1,300	145
West Virginia	900	600	65	1,100	120
Tennessee	900	700	80	1,400	155
Georgia	700	500	70	900	130
Florida	600	500	85	1,000	165
TOTAL OF 10 HIGHEST STATES	10,800	8,100	75	15,100	140
NATIONAL TOTAL	15,000	11,400	75	20,700	140

SECTION II

EMISSION ESTIMATION AND COMPARISON METHODOLOGY

A. DATA SOURCES

A variety of data sources were employed in developing the database used in this study. The major results are based on our own analyses of primary data collected and automated by the U.S. Department of Energy's Energy Information Administration. For purposes of comparison, however, we have also included data developed by others.

Table II-1 summarizes the data sources used. Appendix A discusses the information selected from each of these files in detail. Our definition of "plant" is identical to that used by the Department of Energy in the assignment of the Office of Regulatory Information System (ORIS) plant codes. We aggregated data from units at a single site even if these units are operated by different utilities. In addition, facilities owned by an industrial user and dedicated to producing electricity for industrial uses were excluded even if they exist at a site that is also producing electricity for public distribution. Our analyses included all fossil-fueled units, both steam and non-steam. The data files were merged by plant to create a file containing a single record for each plant with all data elements of interest.

Due primarily to different reporting requirements, the number of plants included in each database varied considerably. Table II-2 shows the number of

Table II-1

OVERVIEW OF ESTIMATES AND SOURCES USED

Estimate	Source
1980	Energy Information Administration (FPC Form 4, FPC Form 423), Environmental Protection Agency (Utility FGD* Survey)
1979	Energy Information Administration (FPC Form 4, FPC Form 423), Environmental Protection Agency (Utility FGD Survey)
1978	Energy Information Administration (FPC Form 4, FPC Form 423), Environmental Protection Agency (Utility FGD Survey)
1977	Energy Information Administration (FPC Form 4, FPC Form 423), Environmental Protection Agency (Utility FGD Survey)
1976	Energy Information Administration (FPC Form 4, FPC Form 423), Environmental Protection Agency (Utility FGD Survey)
AIRTEST	Teknekron Research Inc. (AIRTEST model output for "Q79"), EPA (Utility FGD Survey)
1979 Form 67	Energy Information Administration (FPC Form 67) as collected by E.H. Pechan & Associates, Inc.

* Flue gas desulfurization.

Table II-2

NUMBER OF PLANTS FOR EACH DATA FILE

Data File	Number of Plants
Input Files	
1976 Form 4	1,939
1977 Form 4	1,963
1978 Form 4	1,958
1979 Form 4	1,962
1980 Form 4	1,949
1976 Form 423	889
1977 Form 423	907
1978 Form 423	907
1979 Form 423	929
1980 Form 423	919
1979 Form 67 Subset	77
AIRTEST File	693
Scrubber File	49
Output File	
Combined File	2,081
Final Master File	1,878
200 Highest File	237

plants in each of the input and output files. The highest number of plants was reported in the Form 4 (generation and fuel consumption) file. Fewer plants were reported in the Form 423 (fuel quality) files since detailed fuel quality information must be supplied only for larger plants.

Data from the generation (Form 4) and fuel quality (Form 423) files enable us to calculate SO_2 emissions based on emission factors. These primary data sources are monthly surveys whose results are published in various reports by the Department of Energy. The information collected on these forms is important to utilities, e.g., fuel quality limits are part of most utility

fuel purchase contracts. In addition, DOE tries to ensure that the Form 4 and Form 423 databases are both timely and accurate. The utilities themselves are also required to calculate their SO_2 emissions and report them on FPC Form 67. Utility-calculated SO_2 emissions are not available from Form 67 after 1976 in an automated form. As compared with Forms 4 and 423, Form 67 is not as accurate a source of information. Since Form 67 is not currently used in any publications, completeness, accuracy, and timeliness of filing are not as carefully tracked by the sponsoring organization. In addition, utilities do not generally use Form 67 data. Therefore, they have much less incentive in ensuring their accuracy. Because of the cost and difficulty of collecting and, more importantly, validating Form 67 data, we limited our review to one year (1979) and to a subset of plants consisting of 77 of the highest utility SO_2 emitting plants in 1980 (2 of which did not file forms).

The AIRTEST file contained 693 plants, including all but 4 of the 200 highest SO_2 emitting plants. The base file for the AIRTEST model, TEKUTIL, does not cover smaller plants.

Finally, the scrubber file contained information on those plants that were reported to have SO_2 scrubbers installed and operating by 1980.

Three output files were generated from the preceding input files. The file that combined all of the data from the input files contained information on 2,081 separate plants. Eliminating plants that had less than one ton per year of SO_2 emissions (small and gas-fired plants) reduced the number of plants to 1,878. Finally, we selected a subset of all plants included in the

200 highest SO_2 emitting plants in any year analyzed. This file contained 237 plants.

Emissions were calculated using information on fuels used for generating electricity (supplied by FPC Form 4) and percent sulfur in fuels (supplied by FPC Form 423). For those cases in which fuel quality data were not provided, state average sulfur content values were utilized (see Appendix D). The quantities of fuels for which sulfur contents were not repeated and which had to be defaulted was small over the entire study period (see Table II-3). Between 1 and 1.5 percent of coal use was not accounted for; the comparable figures for oil were higher. To reduce these figures somewhat, a special search of DOE records was made for coal plants consuming 100,000 tons per year or more and not reporting coal sulfur content and for oil plants consuming 100,000 barrels or more per year and not reporting oil sulfur content. This procedure reduced the unavailability figures reported in Table II-3 by about 50 percent.

Table II-3

FUEL QUANTITIES FOR WHICH
REQUIRED FORM 423 FUEL QUALITY DATA WERE UNAVAILABLE

	1976	1977	1978	1979	1980
Coal (million tons)	6.87	6.72	6.49	6.70	6.24
Percent of Total	1.5	1.4	1.3	1.3	1.1
Oil (million barrels)	15.13	15.44	17.33	13.73	5.85
Percent of Total	2.7	2.5	2.7	2.6	1.4

The basic calculations for SO_2 emissions were relatively straightforward. For coal, we multiplied the quantity of fuels used times the percent sulfur times two (one ton of sulfur burned will produce almost exactly two tons of sulfur dioxide since the atomic weight of sulfur is almost exactly twice that of oxygen, and SO_2 contains two oxygen atoms per sulfur atom). For coal-fired plants, we assumed an SO_2 ash retention value of between 5 and 25 percent based on quality of coal. For bituminous coals (as defined by heating value), a 5 percent ash retention factor was used. Fifteen percent was assumed for sub-bituminous coal, and 25 percent for lignite coal.

The 5 percent ash retention figure is recommended for use for bituminous coals in the emissions factor listing produced by EPA's Office of Air Quality Planning and Standards.[1] The same report (AP-42) utilizes a 6.3 percent ash retention for lignite. The values we used are those adapted by the EPA-DOE acid rain mitigation study. They are also in agreement with revised AP-42 emission factors, which are currently being reviewed. Use of the currently released AP-42 factors would increase the national estimate by 0.2 million tons, or about 1.2 percent.

For oil- and gas-fired plants, the AP-42 emission factors and calculations methods were employed.

Emission reductions resulting from SO_2 scrubbing systems were also accounted for. For each plant with SO_2 scrubbing, we estimated a total equivalent net capacity of "SO_2 free" generation based on the capacity scrubbed, the date of commercial operation, and the SO_2 removal rate. The

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[1] U.S. Environmental Protection Agency, Compilation of Air Pollutant Emission Factors, Appendix C, AP-42, November 1978 revision.

total uncontrolled SO_2 emissions for the plant were then adjusted to account for removal of scrubbed SO_2. For example, assume a plant with the following characteristics:

coal -	bituminous
capacity -	350 megawatts
coal used -	830,000 tons
percent sulfur -	2.0 percent
scrubbed capacity -	100 megawatts
scrubber efficiency -	70 percent

On an annual basis, uncontrolled emissions are 33,200 tons SO_2:

$$830{,}000 \times .02 \times 2.0. \qquad [1]$$

The effect of ash retention of sulfur would reduce this to 31,540 tons:

$$33{,}200 \times 0.95. \qquad [2]$$

The scrubber effect would be computed as 70 megawatts:

$$100 \times 0.7. \qquad [3]$$

The final emissions would be 25,232 tons of SO_2:

$$\frac{(350-70)}{350} \times 31{,}540. \qquad [4]$$

If the scrubber was first operated in August, the 70 megawatts figure above would have been adjusted to five-twelfths of the value above, or 29.16. The value of 29.16 would have replaced 70 in calculation 4.

A summary of default values used in the analysis is presented in Table II-4.

A list of all plants that emitted at least 100 tons per year, categorized by state, appears in Appendix E.

Table II-4

DEFAULT VALUES USED IN THE ANALYSIS

SO_2 Ash Retention in Coal

Rank	Btu/lb	% Retention
Bituminous	>10,000	5%
Sub-bituminous	7,500 - 10,000	15%
Lignite	<7,500	25%

Heating Values for Fuels

Fuel	Btu/unit	Unit
Coal*	10,645	Pound
Residual Oil*	146,260	Gallon
Distillate Oil	150,000	Gallon
Gas*	1,034	Cubic Foot

Sulfur content of distillate oil: 1.0%

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* Source: National average from Form 423 for 1978.

B. FACTORS INFLUENCING EMISSIONS

As shown above, annual emissions are a function of fuel burned, of fuel quality, and of any control applied to the fuel-based emissions. In our analysis, the quantity of fuels burned implicitly accounts for the capacity utilization of the equipment.

We have assumed that the quality of the fuel burned on the average over a year is equal to the quality of the fuel delivered to the plant during the same year. This is not precisely true for coal plants since the majority of such plants maintain a substantial stock of coal, with the result that coal delivered in one year may be burned in another year. The size of the stocks can vary substantially. In particular, plants increase their stocks if a coal strike is anticipated. A prolonged strike will then result in a depletion of stocks.

We have assumed that SO_2 scrubbers are operated continuously at the removal rate for which they were designed and that they scrub the fraction of total plant capacity designed for. Although these assumptions may not reflect the range of possible operating procedures, more detailed information is not readily available. In addition, because of the relatively low number of scrubbed plants, changes in these assumptions would be unlikely to influence our results significantly. Our analysis shows that in 1980 scrubbers reduced overall emissions by less than 10 percent.

SECTION III

RESULTS OF ANALYSIS

A. STATE AND NATIONAL TRENDS

Over the five-year period from 1976 to 1980 covered in this report, SO_2 emissions from the utility industry decreased by about 7.7 percent — from almost 19 million tons to slightly under 17.5 million tons (see Table III-1). At the same time, the total heat value of the fuels used increased by 15 percent (Table I-2). This reduction in SO_2 emissions while fuel use was increasing is due both to the use of lower sulfur coals and to the operation of flue gas desulfurization equipment.

The decrease in emissions during this period was accomplished along with a significant change in the mix of fuels and in electric generation. Table III-1 reports trends in capacity, fuel use, and emissions. The use of oil as a fuel for the generation of electricity has declined dramatically — from 555 million barrels per year in 1976 to 421 million in 1980. The decline from 1978, the year before oil prices doubled, is even more dramatic — 1978 oil usage was nearly 640 million barrels.

Coal use in electricity generation has continued to climb, with an increase of over 20 percent over the 1976 to 1980 period. Natural gas use also increased almost 20 percent over the same period, with the largest natural gas increase paralleling the decrease in oil use after 1978.

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Table III-1

SUMMARY: NATIONAL TRENDS

	1976	1977	1978	1979	1980	% Change 1976-1980
Generating Capacity (gigawatts)	414.4	433.4	448.2	464.1	476.7	15.0
Generation (terawatt-hours)	1,558.5	1,649.1	1,646.4	1,708.4	1,754.3	12.6
Coal Delivered (million tons)	455.5	491.7	477.1	557.1	594.3	30.5
Coal Used (million tons)	448.4	477.2	481.6	527.3	569.4	27.0
(quads)	9.7	10.3	10.3	11.3	12.2	25.8
Oil Used (million barrels)	554.8	623.6	635.8	523.2	420.5	-24.2
(quads)	3.4	3.8	3.9	3.2	2.6	-23.5
Gas Used (TCF)	3.08	3.19	3.19	3.49	3.68	19.5
(quads)	3.1	3.3	3.3	3.6	4.0	29.0
Total SO_2 (million tons)	18.82	19.07	17.59	17.68	17.38	-7.7
Coal SO_2 (million tons)	17.07	17.17	15.60	15.92	15.87	-7.0
Coal SO_2 as a Percent of Total	90.7	90.0	88.7	90.0	91.3	

The percentage of total sulfur oxide emissions resulting from coal emissions has remained relatively constant, about 90 percent of emissions from all fuels. This has occurred despite the increase in the relative quantity of coal used. There are two reasons: (1) the overall decline in sulfur content of coals used and (2) the increase in the fraction of coal capacity equipped with SO_2 scrubbers. With regard to coal sulfur content, the average percentage of sulfur declined by 21 percent between 1976 and 1980 (see Table III-2). During the same period, the average heating value of coals delivered to utilities declined by slightly less than 2 percent. While the use of lower sulfur,

Table III-2

AVERAGE QUALITY OF FUELS DELIVERED TO ELECTRIC UTILITIES

	Year				
	1976	1977	1978	1979	1980
Coal					
Heating Value (Btu/pound)	10,846	10,764	10,645	10,688	10,651
Sulfur Content (percent)	2.12	2.01	1.86	1.80	1.68
Ash Content (percent)	12.89	12.75	12.38	11.70	11.17
Oil					
Heating Value (Btu/gallon)	145,975	145,919	146,270	147,090	147,378
Sulfur Content (percent)	0.96	0.91	0.96	1.02	1.04
Natural Gas					
Heating Value (Btu/cubic foot)	1,023	1,029	1,034	1,034	1,097

lower heating value western coals increased over this period, the lower decline in heating value as compared with sulfur content indicates that the majority of the decrease in average coal sulfur content is not due to extensive use of western coals. This same point was illustrated in Section I, where almost all of the decline in SO_2 emissions was shown to have occurred in the eastern states.

Average oil sulfur content increased by about 8 percent during the period. However, as indicated earlier, total oil-related SO_2 emissions declined due to the greatly reduced use of this fuel.

Table III-3 shows the change in emissions from 1976 to 1980 on the state level. Of the 51 states reported (including the District of Columbia), 27 showed an increase in SO_2 emissions while 22 showed a decline. Year-by-year changes in SO_2 emissions by state are presented in Table III-4.

B. PLANT TRENDS AND ANALYSIS

In this section, the analytical results are displayed for selected subsets of the major SO_2 emitting plants.

Summary statistics reflecting 1980 operating rates and fuel use for the 200 plants emitting the most SO_2 are presented in Table III-5. Of the 200 highest SO_2 emitting plants, only 17 burn no coal. The percentage of coal sulfur reported ranges from 0.48 percent (Navajo) to 6.21 percent (Montrose). Converted to emission rates in pounds per million Btu, the range is from 0.88 (Navajo) to 12.33 (Montrose), a 14-fold difference.

Table III-3

CHANGES IN STATE SO_2 EMISSIONS FROM 1976 TO 1980
(Emissions in 1000 Tons per Year)

State	Rank 1976	1976 Emissions	Rank 1980	1980 Emissions	Change	Percent Change
Alabama	10	704.9	12	543.1	-161.8	-23
Alaska	44	12.8	46	11.7	-1.1	-8
Arizona	29	68.5	27	87.5	19.0	28
Arkansas	35	38.3	41	26.6	-11.7	-31
California	23	151.7	31	77.9	-73.8	-49
Colorado	30	67.9	32	77.5	9.6	14
Connecticut	41	25.2	39	32.1	6.8	27
Delaware	31	60.9	34	52.5	-8.5	-14
District of Columbia	46	7.2	48	4.6	-2.6	-36
Florida	11	673.2	10	725.9	52.6	8
Georgia	13	499.1	9	736.7	237.6	48
Hawaii	34	40.1	36	41.6	1.5	4
Idaho	50	0.0	51	0.0	0.0	0
Illinois	5	1,428.8	5	1,125.6	-303.2	-21
Indiana	3	1,443.1	2	1,539.6	96.5	7
Iowa	19	217.8	18	231.3	13.6	6
Kansas	24	121.1	23	150.1	29.0	24
Kentucky	2	1,512.3	6	1,007.5	-504.7	-33
Louisiana	39	32.9	42	24.8	-8.1	-25
Maine	43	13.0	45	16.3	3.3	26
Maryland	18	218.2	19	223.2	5.0	2
Massachusetts	21	159.6	17	275.5	116.0	73
Michigan	9	887.6	11	565.4	-322.3	-36
Minnesota	16	230.6	21	177.4	-53.2	-23
Mississippi	22	154.1	24	129.2	-24.9	-16
Missouri	7	1,179.4	4	1,140.5	-38.9	-3
Montana	42	16.8	43	23.4	6.6	40
Nebraska	40	27.4	35	49.5	22.1	80
Nevada	38	33.6	37	39.5	5.9	18
New Hampshire	33	50.5	30	80.5	30.0	60
New Jersey	26	113.2	26	110.2	-3.0	-3
New Mexico	27	87.1	28	84.6	-2.6	-3
New York	12	512.8	14	480.3	-32.4	-6
North Carolina	15	410.2	15	435.4	25.2	6
North Dakota	32	58.7	29	82.5	23.8	41
Ohio	1	2,749.8	1	2,171.6	-578.2	-21
Oklahoma	49	0.3	38	37.7	37.4	12,386
Oregon	51	0.0	49	3.3	3.2	48,785
Pennsylvania	4	1,432.0	3	1,466.1	34.1	2
Rhode Island	47	3.0	47	5.2	2.2	73
South Carolina	20	162.2	20	213.1	50.9	31
South Dakota	37	33.9	40	28.6	-5.3	-16
Tennessee	6	1,228.3	8	933.7	-294.7	-24
Texas	25	117.3	16	302.8	185.5	158
Utah	45	12.8	44	22.1	9.3	73

Table III-3 (Continued)

CHANGES IN STATE SO_2 EMISSIONS FROM 1976 TO 1980
(Emissions in 1000 Tons per Year)

State	Rank 1976	1976 Emissions	Rank 1980	1980 Emissions	Change	Percent Change
Vermont	48	0.4	50	0.5	0.1	35
Virginia	17	224.9	22	163.7	-61.2	-27
Washington	36	37.0	33	69.4	32.3	87
West Virginia	8	1,010.4	7	944.2	-66.2	-7
Wisconsin	14	469.7	13	485.7	16.0	3
Wyoming	28	80.9	25	120.9	40.0	49
NATIONAL TOTALS		18,821.4		17,378.5	-1,442.9	-7.7

Table III-4

STATE SO_2 EMISSION TRENDS FROM 1976-1980
(Emissions in 1000 Tons per Year)

State	1976	1977	1978	1979	1980
Alabama	704.9	735.3	530.6	521.3	543.1
Alaska	12.8	12.4	7.7	12.2	11.7
Arizona	68.5	78.3	59.5	81.4	87.5
Arkansas	38.3	54.3	58.9	40.6	26.6
California	151.7	156.2	107.6	108.0	77.9
Colorado	67.9	78.5	76.6	77.4	77.5
Connecticut	25.2	23.5	26.0	27.6	32.1
Delaware	60.9	59.2	55.6	61.1	52.5
District of Columbia	7.2	12.6	10.4	6.7	4.6
Florida	673.2	657.8	595.1	658.7	725.9
Georgia	499.1	581.2	616.2	666.1	736.7
Hawaii	40.1	42.7	38.4	46.1	41.6
Idaho	0.0	0.0	0.0	0.0	0.0
Illinois	1,428.8	1,367.0	1,292.9	1,167.7	1,125.6
Indiana	1,443.1	1,457.6	1,351.2	1,536.9	1,539.6
Iowa	217.8	236.0	263.7	230.8	231.3
Kansas	121.1	138.9	159.3	142.3	150.1
Kentucky	1,512.3	1,356.5	1,210.0	1,130.0	1,007.5
Lousiana	32.9	58.5	63.8	39.6	24.8
Maine	13.0	9.9	8.7	10.9	16.3
Maryland	218.2	198.0	220.5	205.2	223.2
Massachusetts	159.6	160.4	258.9	264.5	275.5
Michigan	887.6	905.1	806.9	741.0	565.4
Minnesota	230.6	230.5	190.3	163.6	177.4
Mississippi	154.1	198.0	208.7	166.1	129.2
Missouri	1,179.4	1,201.9	1,013.6	1,076.2	1,140.5
Montana	16.8	22.8	21.8	22.9	23.4
Nebraska	27.4	31.4	37.9	38.8	49.5
Nevada	33.6	35.6	38.6	47.0	39.5
New Hampshire	50.5	59.4	52.3	78.9	80.5
New Jersey	113.2	128.4	115.3	105.1	110.2
New Mexico	87.1	103.7	81.4	76.7	84.6
New York	512.8	548.0	520.0	508.1	480.3
North Carolina	410.2	427.2	396.4	379.5	435.4
North Dakota	58.7	65.2	71.6	82.3	82.5
Ohio	2,749.8	2,686.1	2,462.6	2,514.5	2,171.6
Oklahoma	0.3	3.1	13.0	19.5	37.7
Oregon	0.0	0.3	0.1	0.9	3.3
Pennsylvania	1,432.0	1,381.1	1,322.7	1,415.1	1,466.1
Rhode Island	3.0	3.6	3.4	2.8	5.2
South Carolina	162.2	194.4	192.9	191.1	213.1
South Dakota	33.9	30.2	32.4	27.8	28.6
Tennessee	1,228.3	1,257.6	1,033.1	893.3	933.7
Texas	117.3	143.3	179.8	221.7	302.8
Utah	12.8	32.2	29.9	30.4	22.1

Table III-4 (Continued)

STATE SO_2 EMISSION TRENDS FROM 1976-1980
(Emissions in 1000 Tons per Year)

State	1976	1977	1978	1979	1980
Vermont	0.4	0.4	0.3	0.4	0.5
Virginia	224.9	238.0	223.9	203.2	163.7
Washington	37.0	53.9	69.8	79.3	69.4
West Virginia	1,010.4	1,001.4	895.5	955.9	944.2
Wisconsin	469.7	514.7	471.7	496.3	485.7
Wyoming	80.9	97.7	95.7	111.1	120.9
TOTALS	18,821.4	19,070.8	17,593.2	17,684.9	17,378.5

Table III-5

1980 SUMMARY STATISTICS FOR THE
200 HIGHEST SO_2 EMITTING UTILITY PLANTS

1980 SO_2 Rank	Plant Name	State	SO_2 Emissions (1000 tons)	SO_2 Emission Rate (lbs/MMBtu)	Coal Consumed (1000 tons)	Coal Sulfur (%)	Coal Share of SO_2 (%)
1	Gavin	Ohio	376.4	5.1	7770	2.85	>99
2	Cumberland	Tennessee	356.8	6.5	5040	3.72	>99
3	Paradise	Kentucky	342.7	6.8	4630	3.89	>99
4	Gibson Station	Indiana	305.6	4.9	5840	2.75	>99
5	Clifty Creek	Indiana	288.2	6.4	4100	3.70	>99
6	Baldwin	Illinois	259.3	5.2	4670	2.92	>99
7	Bowen	Georgia	248.1	2.8	7210	1.81	>99
8	Muskingum	Ohio	244.0	7.7	2820	4.55	>99
9	Labadie	Missouri	237.2	4.2	5110	2.44	>99
10	Monroe	Michigan	233.9	2.9	6330	1.94	>99
11	Harrison	West Virgina	215.0	4.0	4030	2.81	>99
12	Wansley	Georgia	209.8	3.7	5060	2.18	>99
13	Kincaid	Illinois	205.5	6.5	3110	3.48	>99
14	Conemaugh	Pennsylvania	205.2	3.8	4380	2.46	>99
15	Kyger Creek	Ohio	202.3	6.2	2720	3.91	>99
16	Conesville	Ohio	200.8	5.2	3460	4.60	>99
17	Madrid	Missouri	198.9	5.6	3260	3.21	>99
18	Mitchell	West Virginia	171.3	4.0	3500	2.57	>99
19	Hatfield	Pennsylvania	171.2	4.1	3520	2.56	>99
20	Homer City	Pennsylvania	169.1	3.2	4530	1.96	>99
21	Gaston	Alabama	169.1	2.8	5000	1.78	>99
22	Montrose	Missouri	162.0	11.7	1370	6.21	>99
23	Eastlake	Ohio	155.0	4.9	2600	3.14	>99
24	Big Bend	Florida	153.2	4.6	2830	2.84	>99
25	Kammer	West Virginia	149.1	6.7	1860	4.23	>99
26	Keystone	Pennsylvania	142.3	2.7	4300	1.74	>99
27	Brunner Island	Pennsylvania	139.0	3.0	3650	2.00	>99
28	Coffeen	Illinois	137.3	6.9	2110	3.82	>99
29	Gallatin	Tennessee	137.1	4.5	2520	2.86	>99
30	Sammis	Ohio	137.0	2.5	4450	1.62	>99
31	Johnsonville	Tennessee	135.3	3.7	3110	2.28	>99
32	Cardinal	Ohio	126.0	3.0	3600	1.84	>99
33	Colbert	Alabama	125.9	3.7	2930	2.26	>99
34	Hill	Missouri	121.6	8.5	1500	4.78	>99
35	Cayuga	Indiana	115.9	4.1	2710	2.25	>99
36	Stuart	Ohio	112.8	1.8	5440	1.09	>99
37	Montour	Pennsylvania	109.5	2.3	3790	1.52	>99
38	Petersburg	Indiana	108.5	2.9	3420	2.55	>99
39	Yates	Georgia	106.6	3.1	2910	1.93	>99
40	Amos	West Virginia	105.1	1.2	7070	0.78	>99
41	Joppa	Illinois	100.1	3.3	2580	2.04	>99
42	Sioux	Missouri	97.2	4.5	2090	2.45	>99
43	Shawnee	Kentucky	96.6	2.2	3560	1.44	>99
44	Ft Martin	West Virginia	95.1	3.0	2580	1.94	>99

Table III-5 (Continued)

1980 SUMMARY STATISTICS FOR THE
200 HIGHEST SO_2 EMITTING UTILITY PLANTS

1980 SO_2 Rank	Plant Name	State	SO_2 Emissions (1000 tons)	SO_2 Emission Rate (lbs/MMBtu)	Coal Consumed (1000 tons)	Coal Sulfur (%)	Coal Share of SO_2 (%)
45	Tanners Creek	Indiana	94.9	4.2	1960	2.55	>99
46	Mill Creek	Kentucky	94.1	4.1	2090	3.49	>99
47	Morgantown	Maryland	92.0	2.8	2550	1.86	98
48	Mount Storm	West Virginia	91.7	2.9	2610	1.83	99
49	Miami Fort	Ohio	89.5	2.6	2850	1.63	98
50	Avon Lake	Ohio	89.5	4.1	1780	2.65	>99
51	Kingston	Tennessee	88.6	1.7	4480	1.04	>99
52	Belews Creek	North Carolina	86.6	1.5	4790	0.95	>99
53	Ghent	Kentucky	85.4	3.3	2250	2.00	>99
54	Marshall	North Carolina	85.1	1.6	4340	1.03	>99
55	Burger	Ohio	84.7	6.1	1120	3.97	>99
56	Beckjord	Ohio	84.4	2.8	2680	1.65	>99
57	Gorgas 2 and 3	Alabama	84.3	2.4	2920	1.52	>99
58	Brayton	Massachusetts	83.2	2.1	670	1.16	18
59	Sevier	Tennessee	81.4	3.2	2090	2.05	>99
60	Four Corners	New Mexico	80.7	1.1	8020	0.70	>99
61	La Cygne	Kansas	78.0	2.5	3480	2.27	>99
62	Northport	New York	77.6	2.2	0	N/A	0
63	Crist	Florida	76.3	3.6	1590	2.52	>99
64	S. Oak Creek	Wisconsin	75.7	4.7	1530	2.60	>99
65	Michigan City	Indiana	75.4	4.7	1470	2.70	>99
66	Allen	Tennessee	73.9	3.7	1660	2.34	>99
67	Crystal River	Florida	72.6	3.1	1970	1.94	>99
68	Breed	Indiana	71.0	6.6	980	3.83	>99
69	Canal	Massachusetts	70.6	2.3	0	N/A	0
70	Roxboro	North Carolina	70.5	1.2	4870	0.76	>99
71	Ashtabula	Ohio	68.5	5.6	970	3.68	>99
72	Coleman	Kentucky	68.3	4.0	1510	2.38	>99
73	Centralia	Washington	68.3	1.7	4950	0.81	>99
74	Monticello	Texas	68.2	1.1	10610	0.60	98
75	Widows Creek	Alabama	67.4	1.7	3310	1.63	>99
76	Wabash River	Indiana	66.0	3.9	1530	2.27	>99
77	Watson	Mississippi	65.9	3.6	1350	2.57	>99
78	Campbell	Michigan	65.5	3.1	1830	1.87	>99
79	Asbury	Missouri	65.0	9.3	660	5.18	>99
80	Shawville	Pennsylvania	64.7	3.2	1630	2.08	>99
81	Culley	Indiana	63.7	5.4	1080	3.11	>99
82	Navajo	Arizona	63.3	0.8	6890	0.48	>99
83	Martins Creek	Pennsylvania	60.3	1.5	790	2.10	52
84	Gallagher	Indiana	59.5	5.1	1050	2.97	>99
85	Edgewater	Wisconsin	58.0	5.2	1060	2.89	>99
86	Big Sandy	Kentucky	57.9	1.9	2530	1.20	>99
87	Anclote	Florida	57.0	2.4	0	N/A	0
88	Bruce Mansfield	Pennsylvania	56.6	1.2	3910	3.30	>99

Table III-5 (Continued)

1980 SUMMARY STATISTICS FOR THE
200 HIGHEST SO_2 EMITTING UTILITY PLANTS

1980 SO_2 Rank	Plant Name	State	SO_2 Emissions (1000 tons)	SO_2 Emission Rate (lbs/MMBtu)	Coal Consumed (1000 tons)	Coal Sulfur (%)	Coal Share of SO_2 (%)
89	Harllee Branch	Georgia	55.1	1.9	2330	1.24	>99
90	Brown	Kentucky	53.2	3.2	1340	2.09	>99
91	Merrimack	New Hampshire	52.3	3.6	1080	2.55	>99
92	Roseton	New York	52.3	1.9	0	N/A	0
93	Dunkirk	New York	52.0	3.2	1270	2.15	>99
94	Rush Island	Missouri	51.9	1.7	2850	0.96	>99
95	Big Brown	Texas	51.3	1.3	5700	0.60	>99
96	Huntley	New York	50.6	2.3	1740	1.53	>99
97	Chalk	Maryland	50.4	2.4	1090	1.78	73
98	Henderson II	Kentucky	50.2	4.2	1040	2.53	>99
99	Stout	Indiana	50.1	3.2	1430	1.84	>99
100	Frank E. Ratts	Indiana	49.8	6.2	750	3.51	>99
101	Bailly	Indiana	48.9	5.6	790	3.27	>99
102	Cobb-Sandusky	Michigan	48.5	3.4	1140	2.24	>99
103	Meredosia	Illinois	48.1	4.9	850	2.95	>99
104	Hammond	Georgia	47.4	2.6	1470	1.69	>99
105	Port Washington	Wisconsin	46.1	5.4	680	3.55	>99
106	Oak Creek	Wisconsin	45.9	3.9	1010	2.38	>99
107	Dallman	Illinois	45.6	5.3	810	3.26	>99
108	Hawthorne	Missouri	45.4	3.2	1020	2.71	>99
109	St. Clair	Michigan	44.4	1.3	3160	0.71	96
110	Neal	Iowa	44.3	1.1	4060	0.64	>99
111	Barry	Alabama	44.1	1.2	2780	0.83	>99
112	Smith	Kentucky	44.0	4.4	900	2.58	>99
113	Martin Lake	Texas	43.9	0.6	11,090	0.90	99
114	Gannon	Florida	41.9	1.5	1320	1.28	76
115	England	New Jersey	41.3	3.5	600	2.91	80
116	Wateree	South Carolina	41.3	2.1	1560	1.39	>99
117	Parish	Texas	41.1	0.5	5790	0.41	98
118	Bull Run	Tennessee	41.0	1.6	2310	0.93	>99
119	Sporn	West Virginia	40.5	1.6	2130	1.00	>99
120	Pulliam	Wisconsin	40.4	4.5	720	2.95	>99
121	Sibley	Missouri	40.4	5.5	670	3.15	>99
122	Cheswick	Pennsylvania	40.0	2.3	1380	1.52	>99
123	Sunbury	Pennsylvania	39.7	2.7	1330	1.57	>99
124	Gerald Andrus	Mississippi	39.5	2.8	0	N/A	0
125	Jim Bridger	Wyoming	39.3	0.7	5650	0.54	>99
126	Hennepin	Illinois	38.5	4.2	820	2.47	>99
127	Salem Harbor	Massachusetts	38.0	2.2	0	N/A	0
128	Allen	North Carolina	38.0	1.4	2240	0.89	>99
129	Genoa No. 3	Wisconsin	37.5	4.2	910	2.41	>99
130	Fort Myers	Florida	36.5	2.2	0	N/A	0
131	J. T. Deely	Texas	35.8	1.5	2920	0.72	>99
132	Dickerson	Maryland	35.6	2.4	1170	1.58	>99

Table III-5 (Continued)

1980 SUMMARY STATISTICS FOR THE
200 HIGHEST SO_2 EMITTING UTILITY PLANTS

1980 SO_2 Rank	Plant Name	State	SO_2 Emissions (1000 tons)	SO_2 Emission Rate (lbs/MMBtu)	Coal Consumed (1000 tons)	Coal Sulfur (%)	Coal Share of SO_2 (%)
133	Cane Run	Kentucky	35.6	2.2	1360	3.38	>99
134	Columbia	Wisconsin	35.0	1.1	3600	0.57	>99
135	King	Minnesota	34.7	2.8	1340	1.52	>99
136	Leland Olds	North Dakota	34.3	1.6	3260	0.70	>99
137	Mohave	Nevada	33.1	0.9	3170	0.55	>99
138	Sherburne County	Minnesota	32.8	0.8	5030	0.79	>99
139	Valley	Wiconsin	32.8	4.2	630	2.76	>99
140	Cliffside	North Carolina	32.5	1.6	1670	1.02	>99
141	Eddystone	Pennsylvania	32.4	1.8	800	1.88	88
142	Kapp	Iowa	32.3	5.1	600	2.81	>99
143	Armstrong	Pennsylvania	32.2	2.7	970	1.75	>99
144	Portland	Pennsylvania	32.2	3.1	780	2.15	>99
145	Karn-Weadock	Michigan	32.2	1.0	1280	0.86	65
146	Naughton	Wyoming	32.1	1.5	2170	0.87	>99
147	Boswell	Minnesota	32.0	1.3	2790	0.85	>99
148	McDonough	Georgia	31.7	3.1	850	1.97	>99
149	Poston	Ohio	31.5	5.9	460	3.62	>99
150	Cape Canaveral	Florida	31.3	1.4	0	N/A	0
151	Chesterfield	Virginia	31.2	1.7	1110	1.29	87
152	Sanford	Florida	31.1	1.8	0	N/A	0
153	Nelson Dewey	Wisconsin	30.7	5.3	550	2.93	>99
154	Canadys	South Carolina	30.7	2.4	980	1.64	>99
155	Manatee	Florida	29.8	1.0	0	N/A	0
156	Meramec	Missouri	29.3	2.0	1170	1.32	>99
157	Milliken	New York	28.9	3.0	820	1.85	>99
158	Joliet	Illinois	28.6	0.9	3270	0.51	99
159	Possum Point	Virginia	28.6	1.4	20	1.23	2
160	Northside	Florida	28.6	1.7	0	N/A	0
161	Yorktown	Virginia	28.3	1.7	0	N/A	0
162	Indian River	Delaware	28.0	2.3	940	1.54	98
163	Rochester 7	New York	27.7	3.6	610	2.38	>99
164	Greene	Alabama	27.6	2.6	870	1.68	>99
165	Johnston	Wyoming	27.3	1.0	3490	0.46	>99
166	Vermilion	Illinois	27.3	4.9	520	2.78	>99
167	Jefferies	South Carolina	27.2	2.9	740	1.88	97
168	Big Stone	South Dakota	26.8	1.8	2470	0.72	>99
169	Young	North Dakota	26.4	1.1	3700	0.62	>99
170	Kahe	Hawaii	25.9	1.7	0	N/A	0
171	Albright	West Virginia	25.7	2.7	780	1.74	>99
172	Port Jefferson	New York	25.6	2.5	0	N/A	0
173	Mystic	Massachusetts	25.6	1.0	0	N/A	0
174	Quindaro	Kansas	25.4	3.4	420	3.18	>99
175	Greenidge	New York	24.9	3.3	620	2.09	>99

Table III-5 (Continued)

1980 SUMMARY STATISTICS FOR THE
200 HIGHEST SO_2 EMITTING UTILITY PLANTS

1980 SO_2 Rank	Plant Name	State	SO_2 Emissions (1000 tons)	SO_2 Emission Rate (lbs/MMBtu)	Coal Consumed (1000 tons)	Coal Sulfur (%)	Coal Share of SO_2 (%)
176	Powerton	Illinois	24.8	0.9	2750	0.53	>99
177	Sutherland	Iowa	24.7	6.9	340	3.88	>99
178	Mitchell	Pennsylvania	24.6	2.5	700	1.83	>99
179	Niles	Ohio	24.5	4.0	500	2.59	>99
180	Rollin Schahfer	Indiana	24.4	1.1	1910	0.65	97
181	Seward	Pennsylvania	24.4	3.6	540	2.36	>99
182	Toronto	Ohio	24.0	4.8	410	3.08	>99
183	Albany	New York	23.7	2.2	0	N/A	0
184	Bartow	Florida	23.5	2.0	0	N/A	0
185	Mercer	New Jersey	23.4	1.6	1010	1.22	>99
186	Warrick	Indiana	23.3	5.7	370	3.29	>99
187	Clinch River	Virginia	23.2	1.2	1590	0.77	>99
188	Alma-Madgett	Wisconsin	23.1	2.2	1190	1.14	>99
189	Sutton	North Carolina	22.8	1.6	1120	1.06	>99
190	Oswego	New York	22.6	1.1	0	N/A	0
191	North Omaha	Nebraska	22.6	1.7	1280	0.93	>99
192	Riverbend	North Carolina	22.1	1.9	940	1.23	>99
193	New Castle	Pennsylvania	22.1	1.9	930	1.25	>99
194	Bay Shore	Ohio	22.0	1.1	1480	0.78	>99
195	Grand Tower	Illinois	22.0	4.8	410	2.85	>99
196	Burlington	Iowa	21.9	4.8	420	2.74	>99
197	Presque Isle	Michigan	21.4	1.2	1630	0.69	>99
198	Trenton Channel	Michigan	21.3	1.2	1410	0.79	>99
199	Weston	Wisconsin	21.0	5.4	330	3.35	>99
200	Georgetown	South Carolina	21.0	0.9	1810	1.07	>99

N/A - Not applicable.

A summary list of all plants included in the highest emitters in any of the databases examined is presented as Appendix C. Over the set of all seven emission estimates (1980, 1979, 1978, 1977, 1976, AIRTEST, and Form 67), the set of highest emitters includes 237 separate plants.

Of the 25 highest emitting plants in 1980, 15 were also among the 25 highest in 1976, including 8 of the 10 highest (Table III-6). Two plants which greatly increased capacity during this period, Gibson and Wansley, are currently among the 25 highest emitting plants, but were not among the 50 highest emitters in 1976.

C. COMPARISON WITH OTHER RESULTS

As noted above, three additional emissions estimates were included in our results: (1) the National Emissions Data System file provided by EPA's National Air Data Branch and analyzed by EHPA, (2) the 1980 AIRTEST dataset provided by Teknekron Research, Inc. as corrected by EHPA, and (3) the Form 67 data collected by us for the 78 highest SO_2 emitting plants in the nation.

1. NEDS. The National Emissions Data System file contains information on all sources of emissions for five of the criteria air pollutants, including SO_2. The point source file contains over 290,000 separate data records. For our comparative analysis, we selected the approximately 10,000 records that had both an eight-digit Source Classification Code (SCC) of 101XXXXX or 201XXXXX (electric utility fuel combustion) and a Standard Industrial Classification (SIC) code of 4911. While NEDS is a national database, the individual states provide the vast majority of the data, and thus the timeliness of

Table III-6

THE 25 HIGHEST SO_2 EMITTING PLANTS
IN 1980 AND THEIR 1976 EMISSION RANK

Plant Name	1980 Emissions	1980 Rank	1976 Rank	1976 Emissions
Gavin	376.4	1	5	306.8
Cumberland	356.8	2	2	373.3
Paradise	342.7	3	1	459.6
Gibson Station	305.6	4	68	76.8
Clifty Creek	288.2	5	9	285.5
Baldwin	259.3	6	11	268.6
Bowen	248.1	7	14	225.1
Muskingum	244.0	8	3	336.8
Labadie	237.2	9	4	319.4
Monroe	233.9	10	8	286.0
Harrison	215.0	11	13	261.2
Wansley	209.8	12	502	1.3
Kincaid	205.5	13	37	121.8
Conemaugh	205.2	14	33	128.6
Kyger Creek	202.3	15	10	271.1
Conesville	200.8	16	18	205.0
Madrid	198.9	17	44	111.5
Mitchell	171.3	18	20	189.2
Hatfield	171.2	19	23	176.3
Homer City	169.1	20	52	101.2
Gaston	169.1	21	36	124.8
Montrose	162.0	22	27	146.6
Eastlake	155.0	23	15	217.4
Big Bend	153.2	24	34	127.9
Kammer	149.1	25	30	139.3
TOTALS	5,629.7			5,261.1

updates depends on the states. The NEDS file available to us had a range of different years recorded for its electric utility estimates (see Table III-7). About 10 percent of these estimates were for 1980, nearly one-quarter for 1978, and another one-quarter for 1979. The remaining estimates were for 1977 or earlier. When figured as a

Table III-7

REPORTED YEAR OF RECORD FOR NEDS ELECTRIC UTILITY SO_2 ESTIMATES

Reported Year of Record	Percent of Total
1969	<1
1970	1
1971	1
1972	2
1973	3
1974	2
1975	15
1976	6
1977	14
1978	24
1979	23
1980	9

Note: Excludes seven units with no year and one plant reporting 1927.

weighed average, based on weights of SO_2 emissions, the average year of record was slightly later than mid-1977. For this reason, we selected 1978 as the appropriate year for comparison with our statistics.

Table III-8 compares our 1978 emissions estimates with a summary of NEDS statistics. In general, the NEDS statistics are higher than our 1978 estimates; for the nation as a whole, they are 3.8 percent higher. For 20 states, however, our estimates exceeded NEDS.

Differences between our figures and NEDS can be explained only by examining the data at the plant level. We selected five states with

Table III-8

SUMMARY COMPARISON OF 1978 UTILITY EMISSIONS ESTIMATES
WITH NEDS RESULTS
(Emissions in 1000 tons per year)

State	1978 Emissions	NEDS Emissions	Difference	Difference As % of 1978
Alabama	530.6	597.7	67.1	12.6
Alaska	7.7	1.1	-6.7	-86.4
Arizona	59.5	78.0	18.5	31.2
Arkansas	58.9	60.6	1.7	2.8
California	107.6	129.8	22.2	20.6
Colorado	76.6	71.5	-5.1	-6.7
Connecticut	26.0	52.8	26.8	103.0
Delaware	55.6	82.6	27.0	48.5
District of Columbia	10.4	6.6	-3.9	-37.0
Florida	595.1	686.0	90.9	15.3
Georgia	616.2	770.6	154.4	25.1
Hawaii	38.4	40.5	2.1	5.5
Idaho	0.0	0.0	0.0	N/A
Illinois	1292.9	1423.7	130.9	10.1
Indiana	1351.1	1413.1	61.9	4.6
Iowa	263.7	248.3	-15.3	-5.8
Kansas	159.3	143.5	-15.7	-9.9
Kentucky	1210.0	1105.3	-104.7	-8.7
Louisiana	63.8	67.6	3.9	6.1
Maine	8.7	12.9	4.2	48.0
Maryland	220.5	229.0	8.6	3.9
Massachusetts	258.9	138.1	-120.8	-46.7
Michigan	806.9	904.0	97.1	12.0
Minnesota	190.3	180.4	-9.9	-5.2
Mississippi	208.7	117.2	-91.6	-43.9
Missouri	1013.6	1171.5	157.9	15.6
Montana	21.8	22.5	0.7	3.1
Nebraska	37.9	25.3	-12.6	-33.3
Nevada	38.6	48.1	9.5	24.7
New Hampshire	52.3	48.5	-3.8	-7.2
New Jersey	115.3	131.8	16.5	14.3
New Mexico	81.4	125.7	44.2	54.3
New York	520.0	364.6	-155.4	-29.9
North Carolina	396.4	488.6	92.2	23.2
North Dakota	71.6	81.4	9.7	13.6
Ohio	2462.6	2324.8	-137.8	-5.6
Oklahoma	13.0	0.2	-12.8	-98.3
Oregon	0.1	0.1	-0.1	-40.0
Pennsylvania	1322.7	1574.0	251.2	19.0
Rhode Island	3.4	1.3	-2.2	-63.5
South Carolina	192.9	205.2	12.4	6.4
South Dakota	32.4	32.7	0.3	1.0
Tennessee	1033.1	907.5	-125.6	-12.2
Texas	179.8	337.7	158.0	87.9

Table III-8 (Continued)

SUMMARY COMPARISON OF 1978 UTILITY EMISSIONS ESTIMATES
WITH NEDS RESULTS
(Emissions in 1000 tons per year)

State	1978 Emissions	NEDS Emissions	Difference	Difference As % of 1978
Utah	29.9	41.3	11.4	38.1
Vermont	0.3	0.0	-0.3	-98.5
Virginia	223.9	212.0	-12.0	-5.3
Washington	69.8	16.9	-52.9	-75.8
West Virginia	895.5	943.8	48.4	5.4
Wisconsin	471.7	485.5	13.8	2.9
Wyoming	95.7	102.9	7.2	7.5
NATIONAL TOTALS	17,593.2	18,254.7	661.5	3.8

N/A - Not applicable.

both large percentage and large absolute differences for a detailed study. These states were Georgia, Massachusetts, New York, Pennsylvania, and Texas.

For Georgia, the NEDS figure is substantially higher than our own. At least part of this is due to the differing years of record in NEDS: the four Georgia plants in NEDS with over 50,000 tons of SO_2 have years of record of 1977, 1977, 1979, and 1979, respectively. The greatest differences, however, result from coal sulfur values, which are much higher in NEDS for the Bowen and Hammond plants.

In Massachusetts, our figures are higher than NEDS for each of the major NEDS emitters. These differences are explained primarily by the year of record — in NEDS, the most recent reported year is 1975, and at least one plant is reported as of 1969. Massachusetts' emissions have been increasing steadily, due primarily to increases in oil sulfur content. Our 1976 figure for Massachusetts is 159.6 kilotons, much closer to the NEDS figure.

In New York, the major difference is the Northport plant, which we could not locate on the NEDS file and which emitted 78,000 tons of SO_2 in 1978.

Our Pennsylvania NEDS file did not contain plant names, making plant-by-plant comparisons infeasible.

The major difference in Texas was the Big Brown plant, whose NEDS emissions were almost twice our figures. Since coal quantity and

sulfur content were close, this difference must somehow depend on the use of an erroneous emissions factor in NEDS.

A plant-level comparison for the top 25 emitters in NEDS is presented in Table III-9. The development of such comparisons is complicated by the plant name and identification scheme used in NEDS. For some plants, only the name of the operating utility is provided; the plant name must be determined from knowledge of the state and county location of each plant. Plant identification codes provided in NEDS are not related to the DOE code. Furthermore, they can (and often do) change from one update cycle to another.

2. AIRTEST. Table I-7, presented in Section I, compared the AIRTEST results with our 1980 estimates. On a national basis, the results were almost identical. On a state basis, however, the average absolute difference was over 24 percent.

Table III-10 shows the comparison between AIRTEST and our 1980 estimates by state. It is difficult to make direct comparisons to a specific year of data because of the method used by AIRTEST in calculating emissions. Differences such as those in the states of Georgia and Ohio most probably reflect the different assumptions concerning capacity utilization and fuel quality. AIRTEST utilized 1976 generation to estimate capacity utilization, which was combined with 1979 fuel quality data from Form 423. Given changes from 1976 to 1980, differences of several percentage points at the national level, and even more at the state or plant level, would not be unexpected. Thus, the results of our comparison are within the range of expected

Table III-9

COMPARISON OF EMISSIONS FOR 1978 WITH NEDS FOR
THE 25 HIGHEST EMITTERS FROM NEDS
(Emissions in 1000 Tons per Year)

Plant Name	NEDS Rank	NEDS Emissions	1978 Rank	1978 Emissions	NEDS Year of Record	Difference	Difference As a % of 1978
Paradise	1	383.9	1	425.5	1976	-41.6	-9.8
Muskingum	2	335.2	3	312.9	1978	22.3	7.1
Monroe	3	314.3	4	281.3	1979	33.0	11.7
Cumberland	4	313.6	2	316.2	1978	-2.6	-0.8
Labadie	5	310.7	7	251.8	1977	58.9	23.4
New Madrid	6	283.0	20	164.4	1976	118.6	72.1
Gibson	7	281.7	14	190.7	1980	91.0	47.7
Clifty Creek	8	279.6	6	259.1	1980	20.5	7.9
Baldwin	9	268.5	8	249.3	1979	19.2	7.7
Gavin	10	262.1	5	277.3	1978	-15.2	-5.5
Bowen	11	260.6	12	206.7	1977	53.9	26.1
Conesville	12	240.1	13	194.9	1978	45.2	23.2
Kyger Creek	13	222.1	9	225.3	1978	-3.2	-1.4
Mitchell	14	205.8	16	187.3	1979	18.5	9.9
Shawnee	15	202.7	21	156.9	1979	45.8	29.2
Sammis	16	182.2	17	185.7	1978	3.5	1.9
Hatfield	17	181.5	35	118.3	1979	63.2	53.4
Eastlake	18	176.8	18	179.4	1978	-2.6	-1.4
Homer City	19	176.6	24	146.8	1979	29.8	20.3
Johnsonville	20	175.4	11	209.3	1978	-33.9	-16.2
Big Bend	21	168.4	44	107.2	1979	61.2	57.1
Wansley	22	164.3	28	140.2	1979	24.1	17.2
Brunner Island	23	163.1	27	141.9	1978	21.2	14.9
Joppa	24	163.0	45	105.8	1979	57.2	54.1
Harrison	25	159.2	15	189.5	1979	-30.3	-16.0

Table III-10

SUMMARY COMPARISON OF 1980 UTILITY EMISSIONS ESTIMATES
WITH AIRTEST RESULTS
(Emissions in 1000 Tons per Year)

State	1980 Emissions	AIRTEST Emissions	Difference	Difference As a % of 1980
Alabama	543.1	516.5	-26.6	-4.9
Alaska	11.7	N/A	—	—
Arizona	87.5	89.6	2.1	2.4
Arkansas	26.6	57.6	31.0	116.9
California	77.9	161.7	83.8	107.6
Colorado	77.5	80.7	3.2	4.2
Connecticut	32.1	24.1	-8.0	-24.8
Delaware	52.5	48.6	-3.9	-7.4
District of Columbia	4.6	6.1	1.5	32.8
Florida	725.9	714.9	-11.0	-1.5
Georgia	736.7	527.3	-209.4	-28.4
Hawaii	41.6	N/A	—	—
Idaho	0.0	0.0	0.0	0.0
Illinois	1,125.6	1,080.0	-45.6	-4.1
Indiana	1,539.6	1,516.5	-23.1	-1.5
Iowa	231.3	243.7	12.4	5.3
Kansas	150.1	144.6	-5.5	-3.7
Kentucky	1,007.5	1,147.9	140.4	13.9
Louisiana	24.8	22.6	-2.2	-9.0
Maine	16.3	23.1	6.8	41.6
Maryland	223.2	203.3	-19.9	-8.9
Massachusetts	275.5	144.7	-130.8	-47.5
Michigan	565.4	693.4	128.0	22.6
Minnesota	177.4	210.3	32.9	18.6
Mississippi	129.2	134.2	5.0	3.9
Missouri	1,140.5	1,083.5	-57.0	-5.0
Montana	23.4	25.7	2.3	9.8
Nebraska	49.5	42.9	-6.6	-13.3
Nevada	39.5	70.2	30.7	77.9
New Hampshire	80.5	55.2	-25.3	-31.4
New Jersey	110.2	113.6	3.4	3.1
New Mexico	84.6	92.9	8.3	9.8
New York	480.3	515.6	35.3	7.3
North Carolina	435.4	388.7	-46.7	-10.7
North Dakota	82.5	87.9	5.4	6.5
Ohio	2,171.6	2,437.9	266.3	12.3
Oklahoma	37.7	38.9	1.2	3.2
Oregon	3.3	13.9	10.6	327.7
Pennsylvania	1,466.1	1,336.3	-129.8	-8.9
Rhode Island	5.2	3.1	-2.1	-40.4
South Carolina	213.1	190.2	-22.9	-10.7
South Dakota	28.6	24.4	-4.2	-14.6
Tennessee	933.7	960.5	26.8	2.9

Table III-10 (Continued)

SUMMARY COMPARISON OF 1980 UTILITY EMISSIONS ESTIMATES
WITH AIRTEST RESULTS
(Emissions in 1000 Tons per Year)

State	1980 Emissions	AIRTEST Emissions	Difference	Difference As a % of 1980
Texas	302.8	303.2	0.4	0.1
Utah	22.1	34.6	12.5	56.5
Vermont	0.5	0.0	0.5	100.0
Virginia	163.7	220.7	57.0	34.8
Washington	69.4	60.2	-9.2	-13.2
West Virginia	944.2	990.7	46.5	4.9
Wisconsin	485.7	498.8	13.1	2.7
Wyoming	120.9	83.8	-37.1	-30.7
NATIONAL TOTALS	17,378.5	17,464.8	86.3	0.5

N/A - Emissions from these states are not available from AIRTEST.

differences. Plant-specific comparisons for the 25 highest plants in AIRTEST are presented in Table III-11. Major differences, such as those for the Gibson Station, are primarily due to added capacity not accounted for in AIRTEST.

3. Form 67. Another source of estimates is from Department of Energy Form 67 data. The Form 67 data reflect the utilities' own estimates of their SO_2 emissions.

To make the comparison, we manually searched DOE files for the estimates submitted by the highest emitters in 1980. This limited effort resulted in a set of data consisting of 77 plants. After automating these data, we compared the emissions reported on Form 67 with our data for 1979.

The results from the 25 highest Form 67 emitters are shown in Table III-12. The ranks from the two datasets correspond fairly well. For example, the same set of plants are the 8 highest emitters on both lists. Many high emitting plants, however, either do not file Form 67 or file it extremely late. High emitting plants not in DOE files when we searched included the Madrid, Cardinal, and Hill plants.

An exception to the general agreement was the Morgantown plant, which reported much higher SO_2 emissions on Form 67 than we had estimated. Based on a careful review, we feel that the Morgantown Form 67 estimate contains either a typographic or a mathemathical error. Other differences are more difficult to diagnose.

Table III-11

COMPARISON OF EMISSIONS FROM 1980 AND AIRTEST
FOR THE 25 HIGHEST SO_2 EMITTERS FROM AIRTEST
(Emissions in 1000 Tons per Year)

Plant Name	AIRTEST Rank	AIRTEST Emissions	1980 Rank	1980 Emissions	Difference (%)
Paradise	1	461.7	3	342.7	34.7
Muskingum	2	338.1	8	244.0	38.6
Gavin	3	327.9	1	376.4	-12.9
Cumberland	4	326.5	2	356.8	-8.5
Clifty Creek	5	325.5	5	288.2	12.9
Baldwin	6	261.5	6	259.3	0.9
Monroe	7	247.3	10	233.9	5.7
Labadie	8	245.4	9	237.2	3.5
Kyger Creek	9	242.2	15	202.3	19.7
Harrison	10	237.1	11	215.0	10.3
Johnsonville	11	207.2	31	135.3	53.1
Mitchell	12	206.5	18	171.3	20.5
Sammis	13	203.2	30	137.0	48.3
Hatfield	14	191.3	19	171.2	11.8
Eastlake	15	190.5	23	155.0	22.9
Bowen	16	187.7	7	248.1	-24.4
Gibson Station	17	173.9	4	305.6	-43.1
Conesville	18	167.3	16	200.8	-16.7
Shawnee	19	161.1	43	96.6	66.8
Brunner Island	20	153.5	27	139.0	10.4
Montrose	21	152.1	22	162.0	-6.1
Madrid	22	148.9	17	198.9	-25.1
Beckjord	23	141.1	56	84.4	67.1
Coffeen	24	137.6	28	137.3	0.2
Kammer	25	136.5	25	149.1	-8.4
TOTALS		5,571.6		5,247.4	6.2

Table III-12

COMPARISON OF EMISSIONS FROM 1979 AND 1979 FORM 67
FOR THE 25 HIGHEST SO_2 EMITTERS BASED ON FORM 67
(Emissions in 1000 Tons per Year)

Plant Name	Form 67 Rank	Form 67 Emissions	1979 Rank	1979 Emissions	Difference (%)
Paradise	1	404.4	1	410.6	-1.5
Gavin	2	394.5	3	354.5	11.3
Muskingum	3	390.5	2	375.0	4.1
Monroe	4	316.2	5	292.3	8.2
Cumberland	5	304.8	4	316.6	-3.7
Baldwin	6	294.1	8	284.4	3.4
Clifty Creek	7	284.0	6	290.7	-2.3
Gibson Station	8	281.8	7	289.0	-2.5
Mitchell	9	225.4	12	206.0	9.4
Morgantown	10	214.6	56	80.5	166.6
Kyger Creek	11	214.0	10	227.7	-6.0
Sammis	12	188.5	16	177.3	6.3
Hatfield	13	181.6	14	184.4	-1.5
Homer City	14	172.9	20	159.4	8.5
Wansley	15	172.9	17	176.0	-1.8
Johnsonville	16	169.3	18	173.4	-2.4
Brunner Island	17	167.3	23	157.3	6.4
Eastlake	18	165.0	24	151.1	9.2
Montrose	19	163.0	27	145.1	12.3
Kammer	20	159.8	25	150.8	6.0
Harrison	21	159.2	21	159.2	0.0
Coffeen	22	159.0	29	139.5	14.0
Kincaid	23	158.7	26	150.3	5.6
Petersburg	24	143.4	36	116.2	23.4
Stuart	25	142.5	30	137.4	3.7
TOTALS		5,627.4		5,304.7	6.1

Note: Madrid, with emissions of 180.8 kilotons and ranked number 16 and Cardinal, with estimated emissions of 158.2 kilotons and ranked number 22 in our 1979 calculations, did not have a Form 67 on file.

As a further comparison, we performed a linear regression on the two sets of estimates for the 77 plants (with a zero intercept). The resulting r^2 statistic was .957, showing excellent agreement. The regression slope was 0.98.

This regression is statistically significant at the 0.0001 level. It implies that the Form 67 estimates are consistently higher than our estimates by about 2 percent. Assuming that the Form 67 data contain no mathematical errors, these differences could be due to one or both of two factors: (1) the difference between fuels reported as received and those burned and (2) the sulfur retained in ash or otherwise not actually emitted. We consider it unlikely that the difference between the sulfur content of fuels received and those burned could be more than a small fraction of a percent. This would imply that the ash retention assumptions would account for most of the difference. Our ash retention assumptions were discussed earlier. The Form 67 instructions call for the calculation of fuel sulfur "minus sulfur content of product removed."[1] Many utilities, however, use a standard 5 percent ash retention value -- a figure that agrees with our estimate for bituminous coal but that is lower than the figure we used for sub-bituminous or lignite coals.

D. SENSITIVITY ANALYSES

1. Ash retention figures. As indicated earlier, some fraction of the sulfur present within coal is retained and captured along with the

[1] U.S. Department of Energy, FPC Form 67, instructions for page 23.

ash resulting from combustion rather than released as a gas. This fraction is not captured by particulate control systems. In our basic analysis, we used the figures agreed to by EPA and DOE in the Acid Rain Mitigation Study. These figures differ by rank of coal. To test the sensitivity of our results to this assumption, we used the estimates from the EPA report AP-42.

Table III-13 presents a state-by-state comparison of 1980 SO_2 estimates based on differing ash retention assumptions. These results show that most of the differences occur in the western states, the predominant users of coals with low heating values.

2. Capacity utilization. An additional sensitivity analysis was conducted to determine the extent to which changes in capacity utilization of large SO_2 emitting plants might affect emissions of this pollutant. As Table III-14 shows, for many states, emissions from the 200 highest emitting plants account for the vast majority of emissions from all plants.

The overall trend in SO_2 emissions has been a slight decline. However, if capacity utilization changes, there is a potential for significant change in emissions from the existing stock of plants. If higher sulfur fuels are less costly, for example, utilities might wish to operate higher SO_2 emitting plants. Capacity utilization could also be affected by utility efforts to "flatten" the load duration curve by storage and load management measures, thus reducing the fraction of electricity generated by high-cost peaking units and increasing the utilization of coal-fired baseload plants. On the other hand, continued declines in demand growth coupled with possible increases in

Table III-13

EFFECTS OF DIFFERENT COAL SULFUR RETENTION ASSUMPTIONS ON 1980 SO_2 EMISSIONS
(Emissions in 1000 Tons per Year)

State	Base Case	AP-42 Assumptions	% Increase over Base
Alabama	543.1	543.1	0.0
Alaska	11.7	11.7	0.0
Arizona	87.5	88.2	0.8
Arkansas	26.6	27.8	4.5
California	77.9	77.9	0.0
Colorado	77.5	80.0	3.2
Connecticut	32.1	32.1	0.0
Delaware	52.5	52.5	0.0
District of Columbia	4.6	4.6	0.0
Florida	725.9	725.9	0.0
Georgia	736.7	736.7	0.0
Hawaii	41.6	41.6	0.0
Idaho	0.0	0.0	0.0
Illinois	1125.6	1154.1	2.5
Indiana	1539.6	1540.7	0.1
Iowa	231.3	242.8	5.0
Kansas	150.1	160.6	7.0
Kentucky	1007.5	1007.5	0.0
Louisiana	24.8	24.8	0.0
Maine	16.3	16.3	0.0
Maryland	223.2	223.2	0.0
Massachusetts	275.5	275.5	0.0
Michigan	565.4	565.4	0.0
Minnesota	177.4	196.0	10.5
Mississippi	129.2	129.2	0.0
Missouri	1140.5	1156.2	1.4
Montana	23.4	26.1	11.5
Nebraska	49.5	51.6	4.2
Nevada	39.5	39.5	0.0
New Hampshire	80.5	80.5	0.0
New Jersey	110.2	110.2	0.0
New Mexico	84.6	94.4	11.6
New York	480.3	480.3	0.0
North Carolina	435.4	435.4	0.0
North Dakota	82.5	82.5	0.0
Ohio	2171.6	2215.9	2.0
Oklahoma	37.7	42.1	11.7
Oregon	3.3	3.6	9.0
Pennsylvania	1466.1	1467.7	0.0
Rhode Island	5.2	5.2	0.0
South Carolina	213.1	213.1	0.0
South Dakota	28.6	28.8	0.7
Tennessee	933.7	933.7	0.0

Table III-13 (Continued)

EFFECTS OF DIFFERENT COAL SULFUR RETENTION ASSUMPTIONS ON
1980 SO_2 EMISSIONS
(Emissions in 1000 Tons per Year)

State	Base Case	AP-42 Assumptions	% Increase over Base
Texas	302.8	318.3	5.1
Utah	22.1	22.1	0.0
Vermont	0.5	0.5	0.0
Virginia	163.7	163.7	0.0
Washington	69.4	77.4	11.5
West Virginia	944.2	944.2	0.0
Wisconsin	485.7	497.2	2.4
Wyoming	120.9	134.7	11.4
NATIONAL TOTALS	17,378.5	17,582.9	1.2

Table III-14

SHARES OF 1980 SO_2 EMISSIONS FROM THE
200 HIGHEST SO_2 EMITTING PLANTS BY STATE
(Emissions in 1000 Tons per Year)

State	Emissions from All Plants	Emissions from 200 Highest Emitting Plants	Emissions from 200 Highest As a Share of All Plants (%)
Alabama	543	518	95
Alaska	12	0	0
Arizona	88	63	72
Arkansas	27	0	0
California	78	0	0
Colorado	77	0	0
Connecticut	32	0	0
Delaware	52	28	54
District of Columbia	5	0	0
Florida	726	582	80
Georgia	737	699	95
Hawaii	42	26	62
Idaho	0	0	0
Illinois	1,126	937	83
Indiana	1,540	1,445	94
Iowa	231	123	53
Kansas	150	103	69
Kentucky	1,008	928	92
Louisiana	25	0	0
Maine	16	0	0
Maryland	223	178	80
Massachusetts	276	217	79
Michigan	565	467	83
Minnesota	177	100	56
Mississippi	129	105	81
Missouri	1,141	1,049	92
Montana	23	0	0
Nebraska	49	23	47
Nevada	39	33	85
New Hampshire	80	52	65
New Jersey	110	65	59
New Mexico	85	81	95
New York	480	386	80
North Carolina	435	358	82
North Dakota	83	61	73
Ohio	2,172	2,073	95
Oklahoma	38	0	0
Oregon	3	0	0
Pennsylvania	1,466	1,365	93
Rhode Island	5	0	0
South Carolina	213	120	56
South Dakota	29	27	93

Table III-14 (Continued)

SHARES OF 1980 SO_2 EMISSIONS FROM THE
200 HIGHEST SO_2 EMITTING PLANTS BY STATE
(Emissions in 1000 Tons per Year)

State	Emissions from All Plants	Emissions from 200 Highest Emitting Plants	Emissions from 200 Highest As a Share of All Plants (%)
Tennessee	934	914	98
Texas	303	240	79
Utah	22	0	0
Vermont	1	0	0
Virginia	164	111	68
Washington	69	68	99
West Virginia	944	893	95
Wisconsin	486	446	92
Wyoming	121	99	82
TOTALS	17,379	14,984	86

peak-to-average demand ratios and baseload use of nuclear plants could result in decreased capacity utilization of large coal-fired plants.

To examine the implications of changing capacity utilization patterns on two variables of interest -- coal consumption and SO_2 emissions -- we simulated two possible changes in capacity utilization of the 200 highest SO_2 emitting plants from their 1980 levels. We examined the effects on coal use and SO_2 of changes in the use of these 200 plants from a capacity utilization of 40 percent to a capacity utilization of 70 percent (the actual use in 1980 was 53 percent). On a national basis and on a base of about 15 million tons, the resulting change in SO_2 emissions would range from a reduction of 24 percent, or 3.6 million tons, to an increase of 38 percent, or 5.7 million tons (see Table III-15). States with no plants among the 200 highest show no effect from this analysis while other states show substantial increases. The highest increase on a percentage basis is in Virginia, which has an increase of over 120 percent. The highest absolute increase, almost 800,000 tons, occurs in Ohio.

Since SO_2 emissions limits are customarily computed on the basis of modeling studies over 3- and 24-hour averaging times based on full load emissions, SO_2 emission changes due to differing capacity factors are unlikely to be constrained by current emission limits.

Implications of the changes for the 25 highest emitting plants are presented in Table III-16. Table III-17 shows that a change in capacity utilization such as that analyzed above would also change utility coal use significantly. For the 200 plants examined, the range would amount to an annual decrease of about 115 million tons of coal to an annual increase of almost 150

Table III-15

IMPLICATIONS OF A RANGE OF CAPACITY UTILIZATION ON SO_2 EMISSIONS
BY STATE FOR THE 200 HIGHEST EMITTERS
(Emissions in 1000 Tons per Year)

State	Maximum .40 Capacity Factor SO_2 Emissions (1000 tons)	State Rank	Actual 1980 Data SO_2 Emissions (1000 tons)	State Rank	Minimum .70 Capacity Factor SO_2 Emissions (1000 tons)	State Rank
Alabama	425	11	518	11	744	11
Alaska	*	*	*	*	*	*
Arizona	37	29	63	29	66	29
Arkansas	*	*	*	*	*	*
California	*	*	*	*	*	*
Colorado	*	*	*	*	*	*
Connecticut	*	*	*	*	*	*
Delaware	16	35	28	33	28	34
District of Columbia	*	*	*	*	*	*
Florida	506	10	582	10	970	9
Georgia	519	9	699	9	928	10
Hawaii	14	36	26	35	26	36
Idaho	*	*	*	*	*	*
Illinois	745	6	937	5	1,331	6
Indiana	1,055	2	1,445	2	1,998	2
Iowa	99	22	123	19	172	22
Kansas	102	20	103	23	191	21
Kentucky	745	7	928	6	1,319	7
Louisiana	*	*	*	*	*	*
Maine	*	*	*	*	*	*
Maryland	150	17	178	18	291	16
Massachusetts	150	16	217	17	262	17
Michigan	351	13	467	12	620	13
Minnesota	82	24	100	24	144	24
Mississippi	102	19	105	22	205	20
Missouri	785	4	1,049	4	1,453	4
Montana	*	*	*	*	*	*
Nebraska	20	33	23	36	34	33
Nevada	32	32	33	32	56	32
New Hampshire	33	31	52	31	58	31
New Jersey	52	26	65	28	92	26
New Mexico	48	27	81	26	85	27
New York	285	14	386	14	514	14
North Carolina	231	15	358	15	410	15
North Dakota	37	30	61	30	65	30
Ohio	1,613	1	2,073	1	2,891	1
Oklahoma	*	*	*	*	*	*
Oregon	*	*	*	*	*	*
Pennsylvania	946	3	1,365	3	1,709	3
Rhode Island	*	*	*	*	*	*
South Carolina	85	23	120	20	152	23
South Dakota	16	34	27	34	28	35

Table III-15 (Continued)

IMPLICATIONS OF A RANGE OF CAPACITY UTILIZATION ON SO_2 EMISSIONS
BY STATE FOR THE 200 HIGHEST EMITTERS
(Emissions in 1000 Tons per Year)

State	Maximum .40 Capacity Factor SO_2 Emissions (1000 tons)	State Rank	Actual 1980 Data SO_2 Emissions (1000 tons)	State Rank	Minimum .70 Capacity Factor SO_2 Emissions (1000 tons)	State Rank
Tennessee	746	5	914	7	1,428	5
Texas	149	18	240	16	260	18
Utah	*	*	*	*	*	*
Vermont	*	*	*	*	*	*
Virginia	102	21	111	21	252	19
Washington	45	28	68	27	78	28
West Virginia	603	8	893	8	1,061	8
Wisconsin	377	12	446	13	696	12
Wyoming	64	25	99	25	114	25
TOTAL	11,366		14,984		20,733	

* Indicates states that do not contain plants in the 200 highest emitters.

Table III-16

IMPLICATIONS OF CHANGES IN CAPACITY UTILIZATION ON SO_2 EMISSIONS OF LARGE SO_2 EMITTING PLANTS

Plant Name	1980 SO_2 Rank	1980 Capacity Utilization	SO_2 Emissions Under Alternative Capacity Utilization Assumptions* (1000 tons)		
			Low	Actual 1980	High
Gavin	1	.64	234.3	376.4	410.1
Cumberland	2	.48	299.0	356.8	523.3
Paradise	3	.45	305.6	342.7	534.8
Gibson Station	4	.53	231.2	305.6	404.5
Clifty Creek	5	.81	142.7	288.2	288.2
Baldwin	6	.61	168.7	259.3	295.2
Bowen	7	.57	174.5	248.1	305.4
Muskingum	8	.47	206.0	244.0	360.6
Labadie	9	.51	185.6	237.2	324.8
Monroe	10	.56	165.8	233.9	290.2
Harrison	11	.61	141.3	215.0	247.3
Wansley	12	.68	123.0	209.8	215.2
Kincaid	13	.49	166.5	205.5	291.3
Conemaugh	14	.64	128.8	205.2	225.4
Kyger Creek	15	.71	114.7	202.3	202.3
Conesville	16	.36	200.8	200.8	387.4
Madrid	17	.67	119.5	198.9	209.1
Mitchell	18	.59	116.5	171.3	203.8
Hatfield	19	.54	125.7	171.2	219.9
Homer City	20	.59	115.6	169.1	202.2
Gaston	21	.67	100.2	169.1	175.4
Montrose	22	.51	127.7	162.0	223.4
Eastlake	23	.56	111.3	155.0	194.9
Big Bend	24	.49	125.3	153.2	219.3
Kammer	25	.70	85.6	149.1	149.8
TOTALS			4,015.9	5,629.7	7,103.8

*Low is based on a maximum of .40 capacity utilization, actual is based on calculated 1980 capacity utilization, and high is based on a minimum of .70 capacity utilization.

Table III-17

IMPLICATIONS FOR STATE COAL USE FROM A RANGE OF CAPACITY UTILIZATION FOR THE 200 HIGHEST SO_2 EMITTING PLANTS

State	All Plants 1980 Coal Use (1000 tons)	200 HIGHEST SO_2 EMITTING PLANTS				
		1980 Coal Use (1000 tons)	High Capacity Factor 1980 Coal Use (1000 tons)	Percent of 1980 Actual Use	Low Capacity Factor 1980 Coal Use (1000 tons)	Percent of 1980 Actual Use
Alabama	19,550	17,807	25,908	145	14,786	83
Alaska	273	0	0	N/A	0	N/A
Arizona	10,916	6,894	7,145	104	4,083	59
Arkansas	1,774	0	0	N/A	0	N/A
California	0	0	0	N/A	0	N/A
Colorado	10,124	0	0	N/A	0	N/A
Connecticut	0	0	0	N/A	0	N/A
Delaware	1,036	942	942	100	533	57
District of Columbia	0	0	0	N/A	0	N/A
Florida	8,785	7,703	11,868	154	6,546	85
Georgia	21,191	19,832	27,062	136	15,065	76
Hawaii	0	0	0	N/A	0	N/A
Idaho	0	0	0	N/A	0	N/A
Illinois	34,611	21,895	33,959	155	18,225	83
Indiana	33,664	29,372	42,766	146	22,162	75
Iowa	10,745	5,419	7,593	140	4,339	80
Kansas	10,034	3,899	6,932	178	3,844	99
Kentucky	24,383	21,217	29,595	139	16,568	78
Louisiana	0	0	0	N/A	0	N/A
Maine	0	0	0	N/A	0	N/A
Maryland	5,908	4,809	7,578	158	3,972	83
Massachusetts	676	676	801	118	458	68
Michigan	22,150	16,780	23,439	140	13,156	78
Minnesota	12,610	9,155	12,272	134	7,012	77
Mississippi	3,072	1,349	2,886	214	1,349	100
Missouri	23,188	19,695	28,385	144	15,154	77
Montana	3,352	0	0	N/A	0	N/A
Nebraska	4,702	1,279	1,941	152	1,109	87
Nevada	4,064	3,170	5,326	168	3,043	96
New Hampshire	1,080	1,080	1,204	111	688	64
New Jersey	2,545	1,602	2,432	152	1,390	87
New Mexico	11,406	8,016	8,403	105	4,802	60
New York	6,446	5,065	5,847	115	3,213	63
North Carolina	23,920	19,979	22,595	113	12,696	64
North Dakota	10,664	6,961	7,387	106	4,189	60
Ohio	48,537	45,089	61,886	137	34,671	77
Oklahoma	5,752	0	0	N/A	0	N/A
Oregon	485	0	0	N/A	0	N/A
Pennsylvania	42,529	37,936	48,435	128	26,666	70
Rhode Island	0	0	0	N/A	0	N/A
South Carolina	7,927	5,096	6,073	119	3,329	65
South Dakota	2,683	2,470	2,560	104	1,463	59

Table III-17 (Continued)

IMPLICATIONS FOR STATE COAL USE FROM A RANGE OF CAPACITY UTILIZATION FOR THE 200 HIGHEST SO_2 EMITTING PLANTS

State	All Plants 1980 Coal Use (1000 tons)	200 HIGHEST SO_2 EMITTING PLANTS				
		1980 Coal Use (1000 tons)	High Capacity Factor 1980 Coal Use (1000 tons)	Percent of 1980 Actual Use	Low Capacity Factor 1980 Coal Use (1000 tons)	Percent of 1980 Actual Use
Tennessee	21,679	21,218	31,206	147	16,233	77
Texas	45,351	36,116	39,046	108	22,312	62
Utah	4,895	0	0	N/A	0	N/A
Vermont	9	0	0	N/A	0	N/A
Virginia	5,560	2,725	4,922	181	2,097	77
Washington	4,950	4,950	5,669	115	3,240	65
West Virginia	28,499	24,537	29,077	119	16,501	67
Wisconsin	13,231	12,214	18,111	148	9,880	81
Wyoming	14,452	11,300	13,302	118	7,483	66
TOTAL	569,410	438,250	584,553	133	322,256	74

N/A - Not applicable.

million tons. The heating value of this large potential increase in coal use is somewhat greater than all the oil used by the industry in 1980.

SECTION IV

DISTRIBUTION OF FUEL USE, GENERATION, AND EMISSIONS IN 1980

In this section we present a variety of information related to SO_2 emissions, fossil fuel use, and total generation by state. The purpose is to provide insights into the geographical distribution of the various variables considered. This information is useful in identifying which states might be affected with regard to SO_2 emissions by various acid deposition control strategies that have been proposed. However, the determination of who would pay for emission reductions is far more complicated in that it involves institutional rather than technological considerations. Further complications are created in that some states such as West Virginia are significant exporters of electricity. Thus, strategies intended to reduce SO_2 emissions from West Virginia plants would likely affect electricity buyers in states such as Pennsylvania.

Table IV-1 shows average SO_2 emissions rates by fuel for each state and over all fuels. The average figures over all fuel uses show a wide variation, ranging from a low of 0 pounds per million Btu in Idaho to a high of 4.5 pounds per million Btu in Missouri. These differences are primarily due to the mix of fuels used. States such as Louisiana, Oklahoma, and Texas use significant quantities of natural gas, which is almost sulfur free, while other states are heavy users of coal. Fuel use distribution by state is presented in Table IV-2.

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Table IV-1

1980 SO_2 EMISSION RATES BY STATE FOR VARIOUS FUELS
(Pounds per 10^6 Btu)

State	Coal	Oil	Gas	All Fossil
Alabama	2.3	0.6	<.01	2.3
Alaska	3.0	1.1	<.01	0.6
Arizona	0.7	0.9	<.01	0.6
Arkansas	0.7	1.5	<.01	0.5
California	N/A	0.4	<.01	0.2
Colorado	0.7	0.9	<.01	0.7
Connecticut	N/A	0.5	N/A	0.5
Delaware	2.4	1.1	<.01	1.5
District of Columbia	N/A	1.0	N/A	1.0
Florida	3.5	1.6	<.01	1.7
Georgia	2.9	1.9	<.01	2.9
Hawaii	N/A	1.2	N/A	1.2
Idaho	N/A	1.1	<.01	0.0
Illinois	3.1	0.8	<.01	2.7
Indiana	4.2	1.1	<.01	4.2
Iowa	2.3	0.8	<.01	2.2
Kansas	1.6	1.8	<.01	1.0
Kentucky	3.6	1.1	<.01	3.6
Louisiana	N/A	1.0	<.01	0.1
Maine	N/A	1.4	N/A	1.4
Maryland	2.5	1.3	<.01	2.1
Massachusetts	1.6	1.8	<.01	1.8
Michigan	2.0	0.8	<.01	1.8
Minnesota	1.6	1.5	<.01	1.5
Mississippi	2.3	2.7	<.01	1.3
Missouri	4.6	1.1	<.01	4.5
Montana	0.8	1.1	<.01	0.7
Nebraska	1.1	1.2	<.01	1.0
Nevada	0.7	0.8	<.01	0.6
New Hampshire	3.6	2.1	N/A	2.9
New Jersey	2.4	0.7	<.01	0.9
New Mexico	0.8	0.7	<.01	0.6
New York	2.8	1.3	<.01	1.4
North Carolina	1.5	1.1	<.01	1.5
North Dakota	1.2	1.1	<.01	1.2
Ohio	3.9	1.2	<.01	3.8
Oklahoma	0.7	1.1	<.01	0.2
Oregon	0.7	1.1	<.01	0.7
Pennsylvania	2.8	0.8	<.01	2.5

Table IV-1 (Continued)

1980 SO_2 EMISSION RATES BY STATE FOR VARIOUS FUELS
(Pounds per 10^6 Btu)

State	Coal	Oil	Gas	All Fossil
Rhode Island	N/A	1.0	N/A	1.0
South Carolina	2.0	2.0	<.01	1.9
South Dakota	1.7	1.0	<.01	1.7
Tennessee	3.7	1.1	N/A	3.7
Texas	0.9	0.9	<.01	0.3
Utah	0.4	0.8	<.01	0.4
Vermont	3.0	1.1	<.01	1.2
Virginia	1.4	1.4	<.01	1.4
Washington	1.7	1.6	<.01	1.7
West Virginia	2.7	1.1	<.01	2.7
Wisconsin	3.6	1.2	<.01	3.4
Wyoming	1.0	1.1	<.01	1.0
NATIONAL AVERAGE	2.6	1.2	<.01	1.9

Table IV-2

1980 TOTAL FOSSIL FUEL USE BY STATE FOR ELECTRIC UTILITIES

State	Coal (million tons)	Oil (million barrels)	Gas (BCF)
Alabama	19.6	0.2	1.4
Alaska	.3	.4	28.8
Arizona	10.9	1.2	49.7
Arkansas	1.8	3.1	58.9
California	0.0	62.7	518.8
Colorado	10.1	.2	31.9
Connecticut	0.0	21.4	0.0
Delaware	1.0	5.8	7.0
District of Columbia	0.0	1.5	0.0
Florida	8.8	70.0	166.0
Georgia	21.2	.7	3.7
Hawaii	0.0	10.2	0.0
Idaho	0.0	0.0	0.0
Illinois	34.6	12.8	19.2
Indiana	33.7	0.0	1.9
Iowa	10.7	.1	6.8
Kansas	10.0	.5	100.9
Kentucky	24.4	0.0	1.9
Louisiana	0.0	7.1	425.0
Maine	0.0	3.6	0.0
Maryland	5.9	8.1	5.2
Massachusetts	0.7	45.7	5.1
Michigan	22.2	9.6	26.4
Minnesota	12.6	.4	8.1
Mississippi	3.1	5.1	95.1
Missouri	23.2	0.0	15.3
Montana	3.4	0.0	4.2
Nebraska	4.7	0.2	11.9
Nevada	4.1	2.4	27.5
New Hampshire	1.1	4.3	0.0
New Jersey	2.5	12.9	79.5
New Mexico	11.4	0.2	56.3
New York	6.4	63.9	124.4
North Carolina	23.9	0.0	1.7
North Dakota	10.7	0.0	0.0
Ohio	48.5	0.6	4.9
Oklahoma	5.8	0.0	329.9
Oregon	0.5	0.0	0.3
Pennsylvania	42.5	17.2	2.9

Table IV-2 (Continued)

1980 TOTAL FOSSIL FUEL USE BY STATE FOR ELECTRIC UTILITIES

State	Coal (million tons)	Oil (million barrels)	Gas (BCF)
Rhode Island	0.0	1.6	1.7
South Carolina	7.9	2.1	5.4
South Dakota	2.7	0.0	0.3
Tennessee	21.7	0.0	1.1
Texas	45.4	0.7	1,430.0
Utah	4.9	0.1	5.1
Vermont	0.0	0.0	0.2
Virginia	5.6	14.6	2.3
Washington	5.0	0.2	0.9
West Virginia	28.5	0.0	0.1
Wisconsin	13.2	0.1	13.7
Wyoming	14.5	0.0	0.2
NATIONAL TOTALS	569.4	391.4	3,681.6

Consideration of other forms of electricity generation can show the extent to which each state depends upon fossil-fueled power. Some states, such as Idaho and Vermont, are much less dependent upon fossil fuel than is the nation as a whole. Generation types by state appear in Table IV-3.

The relative quantities of emissions produced at various emissions rates are illustrated in Table IV-4. In carrying out the analysis summarized on this table, each plant was categorized by its average emission rate in pounds of SO_2 per million Btu; the total emissions from the plant were allocated to all applicable categories below that rate. As expected, there is a high correlation between the states with high total emissions and those with a high rate of significant emissions. As shown in the table, eight states have some plants emitting at rates in excess of six pounds per million Btu. All of these states but Iowa are major emitters.

The same statistics expressed as a percentage of total emissions are presented in Table IV-5. This table reveals that while Ohio has the greatest quantity of emissions at a high rate, other states, such as Tennessee, Kentucky, and Missouri, have higher shares in the highest emissions rate categories.

Tables IV-6 and IV-7 are similar to the preceding two tables except that they report emissions in terms of the incremental share above the specified level rather than in terms of total emissions.

Table IV-3

1980 GENERATION STATISTICS BY STATE
(Terawatt-hours)

State	Fossil	Hydro-Electric	Nuclear	Total	Fossil As a % of Total
Alabama	45.4	9.4	23.5	78.3	58
Alaska	2.6	0.5	0.0	3.1	84
Arizona	27.0	10.0	0.0	37.0	73
Arkansas	10.2	1.7	7.8	19.7	52
California	89.6	42.2	5.0	136.8	65
Colorado	21.2	2.0	0.7	23.9	89
Connecticut	12.6	0.3	11.8	24.7	51
Delaware	6.7	0.0	0.0	6.7	100
District of Columbia	0.7	0.0	0.0	0.7	100
Florida	79.0	0.2	16.7	95.9	82
Georgia	50.5	4.5	8.4	63.4	80
Hawaii	6.5	0.0	0.0	6.5	100
Idaho	0.0	9.5	0.0	9.5	0.0
Illinois	75.7	0.1	27.7	103.5	73
Indiana	70.1	0.5	0.0	70.6	99
Iowa	18.3	0.9	2.6	21.8	84
Kansas	25.1	0.0	0.0	25.1	100
Kentucky	54.2	2.9	0.0	57.1	95
Louisiana	45.8	0.0	0.0	45.8	100
Maine	2.1	1.4	4.4	7.9	27
Maryland	20.0	1.3	10.9	32.2	62
Massachusetts	31.6	1.1	3.2	35.9	88
Michigan	57.9	2.0	15.9	75.8	76
Minnesota	21.0	0.6	10.0	31.6	66
Mississippi	18.5	0.0	0.0	18.5	100
Missouri	48.4	0.6	0.0	49.0	99
Montana	5.5	10.0	0.0	15.5	35
Nebraska	9.3	1.3	5.8	16.4	57
Nevada	11.7	2.4	0.0	14.1	83
New Hampshire	5.1	0.9	0.0	6.0	85
New Jersey	22.1	0.3	7.7	30.1	73
New Mexico	24.6	0.1	0.0	24.7	>99
New York	63.2	28.4	19.3	110.9	57
North Carolina	60.8	5.5	5.8	72.1	84
North Dakota	11.8	2.5	0.0	14.3	83
Ohio	108.1	0.0	2.1	110.3	98
Oklahoma	43.3	1.6	0.0	44.9	96
Oregon	0.8	30.2	5.4	36.4	2
Pennsylvania	109.7	2.2	12.4	124.3	88

Table IV-3 (Continued)

1980 GENERATION STATISTICS BY STATE
(Terawatt-hours)

State	Fossil	Hydro-Electric	Nuclear	Total	Fossil As a % of Total
Rhode Island	1.0	0.0	0.0	1.0	100
South Carolina	21.5	3.8	17.4	42.7	50
South Dakota	2.8	5.8	0.0	8.6	33
Tennessee	51.0	9.6	0.5	61.1	83
Texas	201.9	1.0	0.0	202.9	>99
Utah	11.3	0.8	0.0	12.1	93
Vermont	0.0	0.7	3.0	3.7	0
Virginia	21.9	1.1	11.5	34.5	63
Washington	7.3	83.0	2.0	92.3	8
West Virginia	70.4	0.4	0.0	70.8	99
Wisconsin	26.0	1.9	9.9	37.8	69
Wyoming	22.8	1.1	0.0	23.9	95
NATIONAL TOTALS	1,754.4	286.5	251.6	2,292.5	77

Table IV-4

TOTAL EMISSIONS FROM PLANTS ABOVE A SPECIFIED POUNDS OF SO_2 PER 10^6 BTU LIMIT

State	0.0	0.5	1.0	1.2	1.5	2.0	2.5	3.0	4.0	5.0	6.0
Alabama	543	540	540	530	486	418	323	126	0	0	0
Alaska	12	12	12	9	9	9	9	0	0	0	0
Arizona	88	75	0	0	0	0	0	0	0	0	0
Arkansas	27	17	5	5	0	0	0	0	0	0	0
California	78	6	1	0	0	0	0	0	0	0	0
Colorado	77	70	2	2	0	0	0	0	0	0	0
Connecticut	32	13	0	0	0	0	0	0	0	0	
Delaware	52	52	37	37	33	28	0	0	0	0	0
District of Columbia	5	5	0	0	0	0	0	0	0	0	0
Florida	726	710	649	602	564	439	311	311	163	0	0
Georgia	737	737	736	736	724	658	658	348	0	0	0
Hawaii	42	42	34	31	29	0	0	0	0	0	0
Idaho	0	0	0	0	0	0	0	0	0	0	0
Illinois	1,126	1,118	976	950	935	935	918	918	800	664	343
Indiana	1,540	1,540	1,525	1,500	1,500	1,482	1,480	1,371	1,222	613	413
Iowa	231	231	218	172	163	163	161	149	106	75	25
Kansas	150	131	126	126	126	126	119	41	0	0	0
Kentucky	1,008	1,008	1,008	1,008	1,002	915	764	753	613	343	343
Louisiana	25	12	0	0	0	0	0	0	0	0	0
Maine	16	16	16	16	4	4	0	0	0	0	0
Maryland	223	223	219	200	200	184	92	0	0	0	0
Massachusetts	276	275	254	227	227	215	0	0	0	0	0
Michigan	565	565	523	456	365	364	352	114	0	0	0
Minnesota	177	177	143	142	102	99	78	8	0	0	0
Mississippi	129	125	109	108	108	108	106	66	0	0	0
Missouri	1,141	1,140	1,128	1,127	1,121	1,039	1,039	1,039	992	638	359
Montana	23	23	8	8	0	0	0	0	0	0	0
Nebraska	49	49	28	28	23	0	0	0	0	0	0
Nevada	39	39	0	0	0	0	0	0	0	0	0
New Hampshire	80	80	80	80	80	80	52	52	0	0	0
New Jersey	110	98	72	69	69	46	41	41	0	0	0
New Mexico	85	81	81	0	0	0	0	0	0	0	0
New York	480	447	431	407	401	344	167	138	0	0	0
North Carolina	435	435	435	365	212	0	0	0	0	0	0
North Dakota	82	78	78	49	40	0	0	0	0	0	0
Ohio	2,172	2,171	2,153	2,119	2,117	2,004	2,004	1,555	1,550	1,235	550
Oklahoma	38	24	0	0	0	0	0	0	0	0	0
Oregon	3	3	0	0	0	0	0	0	0	0	0
Pennsylvania	1,466	1,462	1,441	1,437	1,378	1,249	1,082	832	171	0	0

Table IV-4 (Continued)

TOTAL EMISSIONS FROM PLANTS ABOVE A SPECIFIED POUNDS OF SO_2 PER 10^6 BTU LIMIT

State	0.0	0.5	1.0	1.2	1.5	2.0	2.5	3.0	4.0	5.0	6.0
Rhode Island	5	5	0	0	0	0	0	0	0	0	0
South Carolina	213	213	192	190	190	176	38	0	0	0	0
South Dakota	29	29	28	27	27	0	0	0	0	0	0
Tennessee	934	934	934	934	934	804	804	804	494	357	357
Texas	303	259	155	87	0	0	0	0	0	0	0
Utah	22	9	0	0	0	0	0	0	0	0	0
Vermont	1	1	1	0	0	0	0	0	0	0	0
Virginia	164	164	164	113	60	0	0	0	0	0	0
Washington	69	69	69	69	69	0	0	0	0	0	0
West Virginia	944	937	937	926	804	756	748	630	535	149	149
Wisconsin	486	486	483	448	448	446	423	420	362	176	0
Wyoming	121	121	77	32	32	0	0	0	0	0	0
TOTALS	17,379	17,055	16,106	15,371	14,582	13,091	11,769	9,718	7,009	4,249	2,538

Table IV-5

PERCENT OF TOTAL STATE EMISSIONS BASED ON THE TOTAL EMISSIONS FROM PLANTS ABOVE A SPECIFIED POUNDS OF SO_2 PER 10^6 BTU LIMIT

State	0.0	0.5	1.0	1.2	1.5	2.0	2.5	3.0	4.0	5.0	6.0
Alabama	100	99	99	98	89	77	59	23	0	0	0
Alaska	100	100	100	74	74	74	74	0	0	0	0
Arizona	100	85	0	0	0	0	0	0	0	0	0
Arkansas	100	63	19	18	0	0	0	0	0	0	0
California	100	8	1	0	0	0	0	0	0	0	0
Colorado	100	90	2	2	0	0	0	0	0	0	0
Connecticut	100	42	1	0	0	0	0	0	0	0	0
Delaware	100	100	71	71	63	53	0	0	0	0	0
District of Columbia	100	100	0	0	0	0	0	0	0	0	0
Florida	100	98	89	83	78	61	43	43	22	0	0
Georgia	100	100	100	100	98	89	89	47	0	0	0
Hawaii	100	100	82	75	69	0	0	0	0	0	0
Idaho	100	45	45	0	0	0	0	0	0	0	0
Illinois	100	99	87	84	83	83	82	82	71	59	30
Indiana	100	100	99	97	97	96	96	89	79	40	27
Iowa	100	100	94	74	70	70	69	64	46	32	11
Kansas	100	87	84	84	84	84	79	27	0	0	0
Kentucky	100	100	100	100	99	91	76	75	61	34	34
Louisiana	100	50	0	0	0	0	0	0	0	0	0
Maine	100	100	100	99	24	24	0	0	0	0	0
Maryland	100	100	98	90	90	82	41	0	0	0	0
Massachusetts	100	100	92	82	82	78	0	0	0	0	0
Michigan	100	100	93	81	65	64	62	20	0	0	0
Minnesota	100	100	81	80	58	56	44	5	0	0	0
Mississippi	100	96	84	84	84	84	82	51	0	0	0
Missouri	100	100	99	99	98	91	91	91	87	56	31
Montana	100	100	32	32	0	0	0	0	0	0	0
Nebraska	100	98	57	57	46	0	0	0	0	0	0
Nevada	100	99	0	0	0	0	0	0	0	0	0
New Hampshire	100	100	100	100	100	100	65	65	0	0	0
New Jersey	100	89	65	63	63	42	37	37	0	0	0
New Mexico	100	96	96	0	0	0	0	0	0	0	0
New York	100	93	90	85	84	72	35	29	0	0	0
North Carolina	100	100	100	84	49	0	0	0	0	0	0
North Dakota	100	95	95	59	49	0	0	0	0	0	0
Ohio	100	100	99	98	97	92	92	72	71	57	25
Oklahoma	100	63	0	0	0	0	0	0	0	0	0
Oregon	100	100	0	0	0	0	0	0	0	0	0
Pennsylvania	100	100	98	98	94	85	74	57	12	0	0

Table IV-5 (Continued)

PERCENT OF TOTAL STATE EMISSIONS BASED ON THE TOTAL EMISSIONS FROM PLANTS ABOVE A SPECIFIED POUNDS OF SO_2 PER 10^6 BTU LIMIT

State	0.0	0.5	1.0	1.2	1.5	2.0	2.5	3.0	4.0	5.0	6.0
Rhode Island	100	100	2	0	0	0	0	0	0	0	0
South Carolina	100	100	90	89	89	82	18	0	0	0	0
South Dakota	100	100	98	94	94	0	0	0	0	0	0
Tennessee	100	100	100	100	100	86	86	86	53	38	38
Texas	100	86	51	29	0	0	0	0	0	0	0
Utah	100	39	0	0	0	0	0	0	0	0	0
Vermont	100	100	100	73	0	0	0	0	0	0	0
Virginia	100	100	100	69	36	0	0	0	0	0	0
Washington	100	100	100	100	100	0	0	0	0	0	0
West Virginia	100	99	99	98	85	80	79	67	57	16	16
Wisconsin	100	100	100	92	92	92	87	86	75	36	0
Wyoming	100	100	63	27	27	0	0	0	0	0	0
TOTALS	100	98	93	88	84	75	68	56	40	24	15

Table IV-6

INCREMENTAL EMISSIONS FROM PLANTS ABOVE A SPECIFIED POUNDS OF SO_2 PER 10^6 BTU LIMIT

State	0.0	0.5	1.0	1.2	1.5	2.0	2.5	3.0	4.0	5.0	6.0
Alabama	543	425	310	266	209	130	62	23	0	0	0
Alaska	12	9	6	5	4	3	1	0	0	0	0
Arizona	88	30	0	0	0	0	0	0	0	0	0
Arkansas	27	7	1	1	0	0	0	0	0	0	0
California	78	1	0	0	0	0	0	0	0	0	0
Colorado	77	23	1	0	0	0	0	0	0	0	0
Connecticut	32	0	0	0	0	0	0	0	0	0	0
Delaware	52	35	19	16	11	4	0	0	0	0	0
District of Columbia	5	2	0	0	0	0	0	0	0	0	0
Florida	726	526	365	316	247	165	113	73	22	0	0
Georgia	737	608	480	429	353	233	127	42	0	0	0
Hawaii	42	24	13	9	4	0	0	0	0	0	0
Idaho	0	0	0	0	0	0	0	0	0	0	0
Illinois	1,126	923	754	712	656	563	472	383	230	98	35
Indiana	1,540	1,356	1,177	1,108	1,010	853	696	544	285	105	26
Iowa	231	179	134	119	108	90	72	54	27	8	3
Kansas	150	105	80	71	57	34	13	7	0	0	0
Kentucky	1,008	867	726	670	586	453	359	278	151	92	42
Louisiana	25	5	0	0	0	0	0	0	0	0	0
Maine	16	11	5	3	1	1	0	0	0	0	0
Maryland	223	172	121	102	77	41	10	0	0	0	0
Massachusetts	276	197	120	99	66	16	0	0	0	0	0
Michigan	565	415	269	221	178	115	55	7	0	0	0
Minnesota	177	120	74	60	44	25	9	1	0	0	0
Mississippi	129	98	75	68	58	41	25	11	0	0	0
Missouri	1,141	1,014	893	846	776	671	579	487	314	205	138
Montana	23	9	2	1	0	0	0	0	0	0	0
Nebraska	49	26	11	7	3	0	0	0	0	0	0
Nevada	39	16	0	0	0	0	0	0	0	0	0
New Hampshire	80	66	52	47	38	24	16	9	0	0	0
New Jersey	110	66	41	35	27	18	12	6	0	0	0
New Mexico	85	46	11	0	0	0	0	0	0	0	0
New York	480	343	244	210	161	85	39	14	0	0	0
North Carolina	435	287	139	82	18	0	0	0	0	0	0
North Dakota	82	49	19	11	2	0	0	0	0	0	0
Ohio	2,172	1,890	1,610	1,503	1,350	1,105	880	704	422	174	63
Oklahoma	38	4	0	0	0	0	0	0	0	0	0
Oregon	3	1	0	0	0	0	0	0	0	0	0
Pennsylvania	1,466	1,179	907	800	655	441	253	115	3	0	0

Table IV-6 (Continued)

INCREMENTAL EMISSIONS FROM PLANTS ABOVE A SPECIFIED POUNDS OF SO_2 PER 10^6 BTU LIMIT

State	0.0	0.5	1.0	1.2	1.5	2.0	2.5	3.0	4.0	5.0	6.0
Rhode Island	5	3	0	0	0	0	0	0	0	0	0
South Carolina	213	159	106	89	64	25	4	0	0	0	0
South Dakota	29	20	12	8	4	0	0	0	0	0	0
Tennessee	934	807	681	630	554	457	370	284	153	84	30
Texas	303	117	29	11	0	0	0	0	0	0	0
Utah	22	3	0	0	0	0	0	0	0	0	0
Vermont	1	0	0	0	0	0	0	0	0	0	0
Virginia	164	104	45	25	6	0	0	0	0	0	0
Washington	69	49	29	20	8	0	0	0	0	0	0
West Virginia	944	771	605	540	470	368	273	183	64	38	16
Wisconsin	486	417	349	324	293	242	194	148	62	9	0
Wyoming	121	58	13	7	1	0	0	0	0	0	0
TOTALS	17,379	13,642	10,527	9,472	8,100	6,203	4,634	3,374	1733	814	353

Table IV-7

PERCENT OF TOTAL STATE EMISSIONS BASED ON THE INCREMENTAL EMISSIONS FROM PLANTS ABOVE A SPECIFIED POUNDS OF SO_2 PER 10^6 BTU LIMIT

State	0.0	0.5	1.0	1.2	1.5	2.0	2.5	3.0	4.0	5.0	6.0
Alabama	100	78	57	49	38	24	11	4	0	0	0
Alaska	100	76	51	44	37	25	12	0	0	0	0
Arizona	100	34	0	0	0	0	0	0	0	0	0
Arkansas	100	25	5	2	0	0	0	0	0	0	0
California	100	1	0	0	0	0	0	0	0	0	0
Colorado	100	30	1	0	0	0	0	0	0	0	0
Connecticut	100	1	0	0	0	0	0	0	0	0	0
Delaware	100	66	37	30	20	7	0	0	0	0	0
District of Columbia	100	48	0	0	0	0	0	0	0	0	0
Florida	100	73	50	44	34	23	16	10	3	0	0
Georgia	100	83	65	58	48	32	17	6	0	0	0
Hawaii	100	58	31	22	9	0	0	0	0	0	0
Idaho	100	24	3	0	0	0	0	0	0	0	0
Illinois	100	82	67	63	58	50	42	34	20	9	3
Indiana	100	88	76	72	66	55	45	35	19	7	2
Iowa	100	77	58	51	47	39	31	24	12	4	1
Kansas	100	70	53	47	38	23	8	5	0	0	0
Kentucky	100	86	72	66	58	45	36	28	15	9	4
Louisiana	100	21	0	0	0	0	0	0	0	0	0
Maine	100	65	29	15	9	4	0	0	0	0	0
Maryland	100	77	54	46	35	18	4	0	0	0	0
Massachusetts	100	72	44	36	24	6	0	0	0	0	0
Michigan	100	73	48	39	31	20	10	1	0	0	0
Minnesota	100	67	42	34	25	14	5	0	0	0	0
Mississippi	100	76	58	53	45	32	19	9	0	0	0
Missouri	100	89	78	74	68	59	51	43	28	18	12
Montana	100	37	11	6	0	0	0	0	0	0	0
Nebraska	100	53	21	14	5	0	0	0	0	0	0
Nevada	100	40	0	0	0	0	0	0	0	0	0
New Hampshire	100	83	65	58	48	30	20	11	0	0	0
New Jersey	100	60	37	32	24	17	11	6	0	0	0
New Mexico	100	54	13	0	0	0	0	0	0	0	0
New York	100	71	51	44	34	18	8	3	0	0	0
North Carolina	100	66	32	19	4	0	0	0	0	0	0
North Dakota	100	59	24	13	3	0	0	0	0	0	0
Ohio	100	87	74	69	62	51	41	32	19	8	3
Oklahoma	100	11	0	0	0	0	0	0	0	0	0
Oregon	100	31	0	0	0	0	0	0	0	0	0
Pennsylvania	100	80	62	55	45	30	17	8	0	0	0

Table IV-7 (Continued)

PERCENT OF TOTAL STATE EMISSIONS BASED ON THE INCREMENTAL EMISSIONS FROM PLANTS ABOVE A SPECIFIED POUNDS OF SO_2 PER 10^6 BTU LIMIT

State	0.0	0.5	1.0	1.2	1.5	2.0	2.5	3.0	4.0	5.0	6.0
Rhode Island	100	50	0	0	0	0	0	0	0	0	0
South Carolina	100	75	50	42	30	12	2	0	0	0	0
South Dakota	100	70	40	29	13	0	0	0	0	0	0
Tennessee	100	86	73	67	59	49	40	30	16	9	3
Texas	100	39	10	4	0	0	0	0	0	0	0
Utah	100	12	0	0	0	0	0	0	0	0	0
Vermont	100	59	17	5	0	0	0	0	0	0	0
Virginia	100	64	27	15	4	0	0	0	0	0	0
Washington	100	71	41	29	12	0	0	0	0	0	0
West Virginia	100	82	64	57	50	39	29	19	7	4	2
Wisconsin	100	86	72	67	60	50	40	31	13	2	0
Wyoming	100	48	11	6	1	0	0	0	0	0	0
TOTALS	100	79	61	55	47	36	27	19	10	5	2

APPENDIX A

THE UTILITY FUEL QUALITY AND USE DATABASE

The analyses presented in the body of this report were based on a detailed plant-specific database developed for EPA by EHPA and installed on EPA's IBM 370/168 computer in Research Triangle Park, North Carolina. This database has been organized using the Statistical Analysis System (SAS), a software package that provides for simplified database storage and analysis.

The SAS database was developed in steps. First, each of 13 separate micro-databases (see Table A-1) was sorted and extracted from each of the files according to the file type. Tables A-2 through A-6 identify the data elements selected for each of the files used.

Table A-1

INFORMATION INCLUDED IN THE DATABASE

Description	Source
1976 Utility Fuel Delivery Data (FPC Form 423)	Department of Energy
1977 Utility Fuel Delivery Data (FPC Form 423)	Department of Energy
1978 Utility Fuel Delivery Data (FPC Form 423)	Department of Energy
1979 Utility Fuel Delivery Data (FPC Form 423)	Department of Energy
1980 Utility Fuel Delivery Data (FPC Form 423)	Department of Energy
"AIRTEST" Model Plant Inventory with Emissions	Teknekron Research, Inc.
1976 Electric Generation and Fuel Use Data (FPC Form 4)	Department of Energy
1977 Electric Generation and Fuel Use Data (FPC Form 4)	Department of Energy
1978 Electric Generation and Fuel Use Data (FPC Form 4)	Department of Energy
1979 Electric Generation and Fuel Use Data (FPC Form 4)	Department of Energy
1980 Electric Generation and Fuel Use Data (FPC Form 4)	Department of Energy
SO_2 Scrubber Data	Pedco*
1979 Utility SO_2 Emissions	Department of Energy

Note: These data were transcribed from Form 67 and automated by EHPA.

* EPA Utility FGD Survey, data automated by EHPA.

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Table A-2

DATA ELEMENTS EXTRACTED FROM FPC FORM 423

- ORIS* Respondent Code
- ORIS Plant Code
- Year of Data
- FIPS State Code for Plant
- Coal Data
  - Coal Delivered (1,000 tons)
  - Coal Heating Value (Btu per pound)
  - Coal Sulfur Content (percent by weight)
  - Coal Ash Content (percent by weight)
  - Coal Cost (cents/MMBtu)
- Oil Data
  - Oil Delivered (1,000 barrels)
  - Oil Heating Value (Btu per gallon)
  - Oil Sulfur Content (percent by weight)
  - Oil Ash Content (percent by weight)
  - Oil Cost (cents/MMBtu)
- Gas Data
  - Gas Delivered (1,000 MCF)
  - Gas Heating Value (Btu per cubic foot)
  - Gas Cost (cents/MMBtu)

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* Office of Regulatory Information Systems

Table A-3

DATA ELEMENTS EXTRACTED FROM AIRTEST

- State Two-Character Code
- FIPS State Code
- Plant Name Abbreviation
- FIPS County Code
- Form 67 Utility Code
- Form 67 Plant Code
- Total Plant Capacity (MW)
- Total Plant SO_2 Emissions (1,000 tons)
- Coal Data
  - Sulfur Content (percent by weight)
  - Ash Content (percent by weight)
  - Heating Value (Btu per pound)
  - Heat Rate (Btu per Kwh)
  - Coal Capacity Factor (fraction)
  - Coal Capacity (MW)
  - Coal SO_2 Emissions (1,000 tons)
- Oil Data
  - Sulfur Content (percent by weight)
  - Ash Content (percent by weight)
  - Heating Value (Btu per gallon)
  - Heat Rate (Btu per Kwh)
  - Oil Capacity Factor (fraction)
  - Oil Capacity (MW)
  - Oil SO_2 Emissions (1,000 tons)
- Gas Data
  - Heating Value (Btu per CF)
  - Heat Rate (Btu per Kwh)
  - Gas Capacity Factor (fraction)
  - Gas Capacity (MW)
  - Gas SO_2 Emissions (1,000 tons)

Table A-4

DATA ELEMENTS EXTRACTED FROM FORM 4

- ORIS Respondent Code
- ORIS Plant Code
- FIPS State Code
- Average Plant Capacity (MW)
- Generation from Coal (Mwhr)
- Generation from Residual Oil (Mwhr)
- Generation from Gas (Mwhr)
- Generation from Distillate Oil (Mwhr)
- Coal Burned (1,000 tons)
- Residual Oil Burned (1,000 bbls)
- Gas Burned (1,000 MCF)
- Distillate Oil Burned (1,000 bbls)

Table A-5

DATA ELEMENTS CONCERNING SO_2 SCRUBBERS

- ORIS Respondent Code
- ORIS Plant Code
- Equivalent Full Scrubber Capacity in 1970 (MW)
- Equivalent Full Scrubber Capacity in 1971 (MW)
- Equivalent Full Scrubber Capacity in 1972 (MW)
- Equivalent Full Scrubber Capacity in 1973 (MW)
- Equivalent Full Scrubber Capacity in 1974 (MW)
- Equivalent Full Scrubber Capacity in 1975 (MW)
- Equivalent Full Scrubber Capacity in 1976 (MW)
- Equivalent Full Scrubber Capacity in 1977 (MW)
- Equivalent Full Scrubber Capacity in 1978 (MW)
- Equivalent Full Scrubber Capacity in 1979 (MW)
- Equivalent Full Scrubber Capacity in 1980 (MW)

Table A-6

DATA ELEMENTS EXTRACTED FROM FORM 67

- ORIS Plant Code
- Estimated SO_2 Emissions (1,000 tons)

APPENDIX B

AN EXAMPLE OF INFORMATION REPORTED IN THE DATABOOK

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DATA FOR THE 200 LARGEST SO2 EMITTERS (1976-1980)

PLANT: GAVIN
1980 SO2 RANK 1
STATE: OHIO
ORIS CODE 54028 8102

	1976	1977	1978	1979	1980
SO2 EMISSIONS:					
TOTAL (1000 TONS)	306.8	248.2	277.3	354.5	376.4
COAL (1000 TONS)	306.8	248.1	277.0	354.4	376.3
OIL (1000 TONS)	0.0	0.1	0.3	0.1	0.1
GAS (1000 TONS)	0.0	0.0	0.0	0.0	0.0
SCRUBBER OPERATING?	NO	NO	NO	NO	NO
SO2 REM. (1000 TONS)	0.0	0.0	0.0	0.0	0.0
SO2 EMISSIONS RANK	5	9	5	3	1
FUEL USED:					
COAL (1000 TONS)	7426.4	7562.2	8147.3	8206.4	7766.9
OIL (1000 BBLS)	30.4	31.1	159.3	37.5	42.1
GAS (1000 MCF)	0.0	0.0	0.0	0.0	0.0
FUEL HEAT VALUE (10**12 BTU):					
COAL	147.5	142.2	149.0	152.1	146.1
OIL	0.2	0.2	1.0	0.2	0.3
GAS	.	.	.	.	.
TOTAL	147.7	142.4	150.0	152.4	146.4
GENERATION (TWHRS)	15.2	14.4	14.7	15.2	14.7
HEAT RATE (BTU/KWHR)	9730	9930	10160	10000	9970
TOTAL CAPACITY (MW)	2600.0	2600.0	2600.0	2600.0	2600.0
CAPACITY FACTOR	0.66	0.63	0.65	0.67	0.64
FUEL QUALITY:					
COAL SULFUR (%)	2.43	1.93	2.00	2.54	2.85
COAL HEAT (BTU/LB)	9931	9405	9146	9268	9406
COAL ASH (%)	15.15	13.29	12.73	15.26	16.16
OIL SULFUR (%)	0.38	0.59	0.57	0.86	0.54

APPENDIX C

SULFUR DIOXIDE EMISSIONS FROM THE HIGHEST EMITTING PLANTS

Column Heading		Definition
OBS NAMEC	-	Plant Name
RANK80	-	1980 Data Rank
TTSO280	-	1980 Data SO_2 Emissions
RANK79	-	1979 Data Rank
TTSO279	-	1979 Data SO_2 Emissions
RANKF67	-	Form 67 Rank
TSO2F67	-	Form 67 SO_2 Emissions
RANKAT	-	AIRTEST Rank
TOTSOX	-	AIRTEST SO_2 Emissions
RANK78	-	1978 Rank
TTSO278	-	1978 SO_2 Emissions
RANK77	-	1977 Rank
TTSO277	-	1977 SO_2 Emissions
RANK76	-	1976 Rank
TTSO276	-	1976 SO_2 Emissions

EMISSIONS FROM THE LARGEST SO2 EMITTING PLANTS
DATA ARE FOR YEARS 1976 THROUGH 1980
ALSO INCLUDED ARE AIRTEST AND FORM67 (1979) DATA

NAMEC	RANK80	TTSO280	RANK79	TTSO279	RANKF67	TSO2F67	RANKAT	TOTSOX	RANK78	TTSO278	RANK77	TTSO277	RANK76	TTSO276
GAVIN	1	376.4	3	354.5	2	394.50	3	327.9	5	277.3	9	248.2	5	306.8
CUMBERLAND	2	356.8	4	316.6	5	304.80	4	326.5	2	316.2	2	338.5	2	373.3
PARADISE	3	342.7	1	410.6	1	404.40	1	461.7	1	425.5	1	364.4	1	459.6
GIBSON STATION	4	305.6	7	289.0	8	281.80	17	173.9	14	190.7	61	89.1	68	76.8
CLIFTY CREEK	5	286.2	6	290.7	7	284.00	5	325.5	6	259.1	5	287.7	9	285.5
BALDWIN	6	259.3	8	284.4	6	294.10	6	261.5	8	249.5	12	237.4	11	268.6
BOWEN	7	248.1	11	222.3	42	110.30	16	187.7	12	206.7	10	241.8	14	225.1
MUSKINGUM	8	244.0	2	375.0	3	390.50	2	338.1	3	312.9	4	326.9	3	336.8
LABADIE	9	237.2	9	249.2	25	134.20	8	245.4	7	251.8	6	286.9	4	319.4
MONROE	10	233.9	5	292.3	8	316.20	7	247.3	4	281.3	3	330.9	8	286.0
HARRISON	11	215.0	21	159.2	21	159.20	10	237.1	15	189.5	17	216.4	13	261.2
WANSLEY	12	209.8	17	176.0	15	172.90	51	88.1	28	140.2	89	61.5	502	1.3
KINCAID	13	205.5	26	150.3	23	158.70	37	105.8	19	165.7	22	182.3	37	121.8
CONEMAUGH	14	205.2	34	120.1	39	116.30	30	130.3	23	149.8	31	144.3	33	128.6
KYGER CREEK	15	202.3	10	227.7	11	214.00	9	242.2	9	225.5	8	253.9	10	271.1
CONESVILLE	16	200.8	15	200.5	31	130.60	18	167.3	13	194.9	15	230.0	18	205.0
MADRID	17	198.9	15	180.8	.	.	22	148.9	20	164.4	27	155.9	44	111.5
MITCHELL	18	171.3	12	206.0	9	225.40	12	206.5	16	187.5	20	183.6	20	184.2
HATFIELD	19	171.2	14	184.4	13	181.58	14	191.3	35	118.3	32	143.6	23	176.3
HOMER CITY	20	169.1	20	159.4	14	172.90	44	91.2	24	146.8	52	100.2	52	101.2
GASTON	21	169.1	19	171.6	26	141.20	40	103.2	31	127.8	29	148.8	36	124.8
MONTROSE	22	162.0	27	145.1	19	163.00	21	152.1	30	129.3	26	154.7	27	146.6
EASTLAKE	23	155.0	24	151.1	18	165.00	15	190.5	18	179.4	18	192.4	15	217.4
BIG BEND	24	153.2	35	120.0	41	112.10	26	135.3	44	107.2	35	134.5	34	127.4
KAMMER	25	149.1	25	150.8	20	159.80	25	136.5	37	116.5	33	142.2	30	139.3
KEYSTONE	26	142.3	28	140.3	30	132.70	27	133.9	32	124.8	40	123.3	25	154.3
BRUNNER ISLAND	27	139.0	23	157.3	17	167.30	20	153.5	27	141.9	25	165.1	24	165.1
CUFFEEN	28	137.3	29	139.5	22	159.00	24	137.6	41	111.4	37	125.2	29	140.2
GALLATIN	29	137.1	32	122.1	38	119.40	38	105.7	29	133.2	23	180.7	45	110.0
SAMMIS	30	137.0	16	177.3	12	188.50	13	203.2	17	185.7	16	222.0	12	262.1
JOHNSONVILLE	31	135.3	18	173.4	16	169.30	11	207.2	11	209.3	13	234.0	17	211.2
CARDINAL	32	126.0	22	158.2	.	.	32	126.8	25	145.7	49	107.6	38	114.1
COLBERT	33	125.9	52	90.0	77	22.30	53	86.0	26	144.6	14	232.0	16	211.8
HILL	34	121.6	44	102.8	.	.	35	112.2	62	79.0	50	106.6	50	105.0
CAYUGA	35	115.9	31	134.1	27	135.19	43	95.7	40	112.8	45	112.3	63	84.9
STUART	36	112.8	30	137.4	25	142.50	33	124.7	34	119.7	26	159.7	22	174.6
MONTOUR	37	109.5	33	120.6	29	134.00	36	106.8	43	110.2	38	124.0	35	127.0
PETERSBURG	38	108.5	36	116.2	24	143.40	28	133.3	47	94.8	48	108.5	42	114.5
YATES	39	106.6	47	96.9	53	82.00	47	89.5	56	85.9	65	84.1	69	76.7
AMOS	40	105.1	39	114.7	33	123.40	56	85.1	39	113.3	47	110.3	46	109.7
JOPPA	41	100.1	38	115.1	36	121.70	34	118.6	45	105.8	30	146.6	28	143.0
SIOUX	42	97.2	46	96.8	45	98.80	64	77.5	55	87.6	39	124.0	40	116.8
SHAWNEE	43	96.6	37	115.1	34	123.00	19	161.1	21	156.9	7	282.8	6	296.9
FT MARTIN	44	95.1	43	103.8	43	107.10	57	83.5	61	80.0	44	117.6	59	94.0
TANNERS CREEK	45	94.9	51	90.4	47	89.50	48	89.5	60	80.3	34	139.5	32	132.8
MILL CREEK	46	94.1	40	98.6	46	93.30	71	71.8	48	93.8	40	111.1	43	112.3
MORGANTOWN	47	92.0	56	80.5	10	214.60	59	83.2	58	81.7	76	70.6	71	75.4
MOUNT STORM	48	91.7	40	113.6	71	46.68	31	128.3	42	111.0	41	121.3	41	115.2
MIAMI FORT	49	89.5	45	101.1	40	114.20	50	88.6	38	116.2	58	91.9	75	73.6
AVON LAKE	50	89.5	42	107.4	37	121.10	42	101.1	33	121.4	21	182.3	26	150.2
KINGSTON	51	88.6	49	96.2	44	103.90	41	101.4	22	152.7	24	178.4	21	187.1
BELEWS CREEK	52	86.6	59	79.2	52	82.40	60	82.8	49	92.0	66	83.9	57	95.9
GHENT	53	85.4	79	63.8	.	.	76	66.4	70	75.4	70	79.9	58	95.6
MARSHALL	54	85.1	55	80.9	51	85.10	73	69.4	57	85.1	59	91.2	70	76.1

EMISSIONS FROM THE LARGEST SO2 EMITTING PLANTS
DATA ARE FOR YEARS 1976 THROUGH 1980
ALSO INCLUDED ARE AIRTEST AND FORM67 (1979) DATA

NAME	RANK80	TTSO280	RANK79	TTSO279	RANKF67	TSO2F67	RANKAT	TOTSOX	RANK78	TTSO278	RANK77	TTSO277	RANK76	TTSO276
BURGER	55	84.7	54	86.7	54	80.9	55	85.3	53	89.4	55	94.1	64	81.9
BECKJORD	56	84.4	41	108.7	35	122.4	23	141.1	36	116.5	36	137.4	48	107.7
GORGAS 2 AND 3	57	84.3	90	57.0	69	59.5	66	74.4	80	64.6	84	65.5	72	74.7
BRAYTON	58	83.2	53	86.4	72	42.7	152	31.1	50	91.7	148	33.5	152	31.7
SEVIER	59	81.4	71	68.4	65	64.8	68	73.3	83	63.2	56	93.8	61	89.2
FOUR CORNERS	60	80.7	66	73.5	61	69.0	61	81.3	76	66.5	74	74.6	80	70.5
LA CYGNE	61	78.0	72	68.3	74	37.0	81	63.6	59	80.8	77	70.4	139	35.5
NORTHPORT	62	77.6	63	75.3	55	80.0	46	89.6	63	78.4	64	84.5	65	80.8
CHIST	63	76.3	60	77.3	57	78.4	45	89.6	65	78.1	60	89.6	56	98.4
S OAK CREEK	64	75.7	76	66.6	.	.	58	83.5	71	73.4	67	83.9	62	88.7
MICHIGAN CITY	65	75.4	68	69.0	58	73.5	80	63.6	100	52.8	78	69.9	75	74.6
ALLEN	66	73.9	73	68.0	62	67.7	65	76.7	51	91.5	42	114.0	39	117.9
CRYSTAL RIVER	67	72.6	97	51.7	70	58.1	88	59.5	89	58.2	82	66.8	95	57.9
BREED	68	71.0	113	45.1	32	126.7	63	78.3	66	78.0	72	77.4	66	78.1
CANAL	69	70.6	70	68.4	59	73.0	157	30.6	73	70.7	139	37.2	155	31.4
ROXBORO	70	70.5	101	50.2	.	.	72	71.7	115	43.6	96	55.9	78	71.2
ASHTABULA	71	68.5	58	80.3	49	88.0	93	55.5	54	88.8	62	87.2	79	71.2
COLEMAN	72	68.3	57	80.5	50	85.7	74	68.1	76	66.8	79	69.1	67	77.6
CENTRALIA	73	68.3	61	76.5	48	86.3	87	60.0	74	69.6	102	53.9	132	37.0
MONTICELLO	74	68.2	88	58.4	.	.	49	89.2	104	51.0	101	54.0	91	59.7
MIDDLE CREEK	75	67.4	50	95.4	76	23.8	29	130.9	46	104.2	19	186.8	19	202.0
WABASH RIVER	76	66.0	62	75.6	.	.	52	87.8	79	66.1	54	95.7	60	90.6
WATSON	77	65.9	77	64.6	63	66.3	69	73.2	86	60.7	86	64.6	90	80.5
CAMPBELL	78	65.5	81	62.6	64	65.9	70	72.4	68	76.9	73	75.5	84	65.3
ASBURY	79	65.0	86	59.8	66	64.0	89	57.2	96	55.4	110	51.5	98	56.4
SHAWVILLE	80	64.7	67	70.9	60	72.7	75	68.0	85	60.8	83	66.1	86	67.7
CULLEY	81	63.7	74	67.4	56	80.0	84	62.1	69	76.0	66	83.2	87	64.0
NAVAJO	82	63.3	65	59.9	68	60.9	118	41.5	109	46.3	92	60.0	102	54.0
MARTINS CREEK	83	60.3	87	58.6	75	31.6	101	50.5	91	57.9	90	61.2	121	41.0
GALLAGHER	84	59.5	82	62.2	67	63.4	39	104.3	67	77.5	57	92.8	51	102.6
EDGEWATER	85	58.0	92	54.7	.	.	102	49.5	123	40.2	127	42.6	111	45.5
BIG SANDY	86	57.9	109	45.8	.	.	85	60.9	92	57.6	100	54.4	97	56.6
ANCLOTE	87	57.0	134	36.2	.	.	143	35.2	222	17.4	138	37.4	119	41.6
BRUCE MANSFIELD	88	56.6	233	15.8	.	.	237	16.3	236	16.1	296	10.2	294	9.3
MARLLEE BRANCH	89	55.1	132	36.6	.	.	99	51.5	87	59.4	85	65.4	85	65.0
BROWN	90	53.2	69	68.6	.	.	92	56.1	82	63.2	103	55.7	113	43.8
MERRIMACK	91	52.3	94	52.7	.	.	128	37.3	143	32.3	128	42.5	153	31.7
ROSETON	92	52.3	83	61.3	.	.	91	56.4	75	67.7	95	55.9	103	52.4
DUNKIRK	93	52.0	84	60.0	.	.	96	52.7	102	52.1	105	53.4	96	57.4
RUSH ISLAND	94	51.9	103	48.9	.	.	106	47.5	98	54.0	51	102.7	93	58.3
BIG BROWN	95	51.3	112	45.6	.	.	105	48.0	106	49.6	120	45.2	106	48.7
HUNTLEY	96	50.6	107	47.0	.	.	109	46.0	120	41.3	108	52.4	94	58.1
CHALK	97	50.4	93	53.6	.	.	111	45.1	113	44.8	143	35.4	108	47.1
HENDERSON II	98	50.2	75	66.7	.	.	.	.	88	59.2	91	60.5	92	58.4
STOUT	99	50.1	102	49.1	.	.	115	43.8	116	43.2	94	57.9	77	71.4
FRANK E RATTS	100	49.8	106	46.5	.	.	117	42.8	130	37.6	136	38.5	134	36.7
BAILLY	101	48.9	78	64.0	.	.	62	79.8	90	58.0	87	63.5	53	100.9
CORB-SANDUSKY SG	102	48.5	64	75.2	.	.	67	73.8	52	90.5	63	84.6	54	99.3
MEREDOSIA	103	48.1	131	36.6	.	.	150	31.7	171	26.2	133	40.0	128	37.9
HAMMOND	104	47.4	96	51.0	.	.	126	37.6	144	32.0	137	37.7	142	34.6
PORT WASHINGTON	105	46.1	123	41.0	.	.	130	36.7	119	42.3	119	46.4	136	36.2
OAK CREEK	106	45.9	128	37.5	.	.	125	38.0	181	24.6	153	31.1	131	37.1
DALLMAN	107	45.6	111	45.6	.	.	136	34.4	158	29.3	161	28.7	157	30.9
HAWTHORNE	108	45.4	158	28.5	.	.	94	54.2	167	27.6	144	35.4	110	46.1

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ST CLAIR	109	44.4	96	51.9	.	.	98	51.7	105	51.0	53	98.4	49	106.4
NEAL	110	44.3	144	33.4	.	.	100	50.6	138	34.3	176	26.4	163	29.3
HARRY	111	44.1	105	48.7	.	.	104	48.4	139	35.5	106	53.1	109	46.3
SMITH	112	44.0	91	54.7	.	.	95	53.6	94	55.9	75	70.6	76	72.4
MARTIN LAKE	113	43.9	130	37.1	73	39.6	77	66.2	166	27.6	211	20.3	.	.
GANNON	114	41.9	120	42.9	.	.	145	33.0	124	40.1	152	31.4	125	39.3
ENGLAND	115	41.3	115	44.4	.	.	116	43.7	112	45.1	107	52.9	115	43.1
WATEREE	116	41.3	122	41.2	.	.	127	37.6	118	42.4	126	42.9	141	35.0
PARISH	117	41.1	201	20.6	.	.	179	25.4	371	5.2	904	0.0	948	0.0
BULL RUN	118	41.0	139	35.3	.	.	113	44.3	114	44.0	69	80.6	47	108.5
SPORN	119	40.5	135	36.1	.	.	131	36.6	140	33.2	146	34.5	137	36.1
PULLIAM	120	40.4	95	52.6	.	.	107	46.8	107	48.5	112	50.2	114	43.7
SIBLEY	121	40.4	100	50.3	.	.	79	64.1	84	62.6	98	54.4	89	60.9
CHESWICK	122	40.0	108	45.9	.	.	120	40.4	110	46.2	122	44.5	105	50.5
SUNBURY	123	39.7	114	44.5	.	.	121	39.9	97	54.5	80	68.9	81	69.2
GERALD ANDRUS	124	39.5	126	39.9	.	.	119	41.5	93	57.1	104	53.7	117	42.7
JIM BRIDGER	125	39.3	119	42.9	.	.	129	36.7	128	38.1	113	49.6	129	37.8
HENNEPIN	126	38.5	129	37.2	.	.	142	33.4	126	38.5	124	43.5	112	43.9
SALEM HARBOR	127	38.0	125	40.1	.	.	122	39.8	148	30.8	164	28.0	123	40.6
ALLEN	128	38.0	138	35.4	.	.	132	36.6	132	36.1	125	43.4	118	42.5
GENOA NO.3	129	37.5	104	48.8	.	.	103	48.7	117	42.5	118	46.6	116	42.8
FORT MYERS	130	36.5	152	31.4	.	.	296	10.6	223	17.2	149	32.9	239	14.7
J T DEELY	131	35.8	204	20.1	.	.	200	21.9	252	14.2	415	3.4	.	.
DICKERSON	132	35.6	196	21.9	.	.	181	25.3	131	37.5	130	41.7	124	40.2
CANE RUN	133	35.6	117	43.5	.	.	86	60.2	81	63.6	43	116.7	31	134.6
COLUMBIA	134	35.0	148	32.1	.	.	139	34.2	170	26.2	194	22.6	194	22.1
KING	135	34.7	153	31.3	.	.	140	33.7	168	27.5	99	54.4	86	64.5
LELAND OLDS	136	34.3	159	26.4	.	.	172	26.2	149	30.8	160	26.0	179	26.0
MOHAVE	137	33.1	116	43.6	.	.	83	62.2	145	31.8	151	32.0	154	31.5
SHERBURNE COUNTY	138	32.8	162	27.7	.	.	97	52.1	150	30.7	155	31.0	218	17.3
VALLEY	139	32.8	145	32.8	.	.	136	34.2	103	51.1	129	42.0	161	29.9
CLIFFSIDE	140	32.5	142	34.3	.	.	124	39.0	141	32.8	131	41.4	126	39.3
EDDYSTONE	141	32.4	99	50.5	.	.	54	85.9	101	52.3	114	49.5	88	63.6
KAPP	142	32.3	183	24.0	.	.	168	26.7	151	30.5	177	26.3	172	26.9
ARMSTRONG	143	32.2	124	40.9	.	.	144	33.1	157	29.4	117	47.9	135	36.3
PORTLAND	144	32.2	160	28.3	.	.	141	33.5	125	39.6	135	39.4	143	34.1
KARN-WEADOCK	145	32.2	65	74.3	.	.	78	64.8	64	78.4	81	67.4	74	74.4
NAUGHTON	146	32.1	184	23.9	.	.	210	19.7	187	23.7	203	21.6	211	18.8
BOSWELL	147	32.0	178	25.0	.	.	112	44.9	153	30.1	159	29.8	175	26.3
MCDONOUGH	148	31.7	141	34.7	.	.	.	.	147	31.2	142	35.5	130	37.4
POSTON	149	31.5	149	32.0	.	.	153	31.0	197	21.3	166	27.8	144	34.1
CAPE CANAVERAL	150	31.3	137	35.8	.	.	186	24.4	200	20.9	165	28.0	244	13.8
CHESTERFIELD	151	31.2	133	36.4	.	.	90	56.5	122	40.4	121	44.8	104	51.0
SANFORD	152	31.1	180	24.9	.	.	198	22.5	182	24.5	224	18.1	203	20.4
NELSON DEWEY	153	30.7	121	42.3	.	.	123	39.7	146	31.7	123	44.4	122	40.8
CANADYS	154	30.7	199	21.2	.	.	282	12.0	226	16.9	252	14.9	256	12.9
MANATEE	155	29.8	140	35.0	.	.	255	14.5	162	29.0	259	14.0	432	2.6
MERAMEC	156	29.3	154	30.7	.	.	114	44.2	134	35.3	93	58.1	55	98.6
MILLIKEN	157	28.9	174	25.5	.	.	176	25.5	156	29.4	154	31.1	160	29.9
JOLIET	158	28.6	156	29.0	.	.	170	26.4	159	29.2	182	25.3	147	33.5
POSSUM POINT	159	28.6	127	37.7	.	.	133	35.8	121	40.8	134	39.6	127	38.1
NORTHSIDE	160	28.6	176	25.3	.	.	187	24.4	161	29.0	157	30.0	170	27.8
YORKTOWN	161	28.3	118	43.3	.	.	137	34.3	111	45.3	109	51.7	149	33.4
INDIAN RIVER	162	28.0	157	28.9	.	.	174	25.6	180	24.6	179	26.0	159	29.9

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ROCHESTER 7	163	27.7	179	25.0	.	.	177	25.5	175	25.9	170	27.0	199	21.1
GREENE	164	27.6	170	26.0	.	.	167	27.0	137	34.4	140	36.4	145	33.9
JOHNSTON	165	27.3	163	27.5	.	.	195	23.1	174	26.0	188	23.8	197	21.4
VERMILION	166	27.3	164	27.2	.	.	164	28.5	191	22.6	184	25.0	162	29.7
JEFFERIES	167	27.2	206	19.1	.	.	204	20.7	239	15.7	251	14.9	235	15.1
BIG STONE	168	26.8	173	25.6	.	.	191	23.8	154	29.6	178	26.2	174	26.4
YOUNG	169	26.4	150	32.0	.	.	154	31.0	164	28.4	189	23.3	222	16.6
KANE	170	25.9	147	32.5	.	.	.	.	172	26.2	158	29.9	166	28.2
ALBRIGHT	171	25.7	171	25.9	.	.	175	25.5	169	27.3	173	26.6	177	26.1
PORT JEFFERSON	172	25.6	155	30.2	.	.	151	31.3	142	32.4	147	34.5	151	32.0
MYSTIC	173	25.6	200	21.0	.	.	221	16.3	196	21.4	204	21.2	212	18.7
QUINDARO	174	25.4	186	23.6	.	.	382	5.2	218	18.5	214	19.2	187	28.1
GREENIDGE	175	24.9	198	21.3	.	.	256	14.3	211	18.8	199	22.1	272	11.5
PUMERTON	176	24.8	110	45.8	.	.	82	63.2	10	221.4	11	239.9	7	292.8
SUTHERLAND	177	24.7	181	24.7	.	.	155	31.0	165	28.2	263	13.8	266	12.1
MITCHELL	178	24.6	151	31.8	.	.	185	24.6	285	10.4	141	35.7	120	41.5
NILES	179	24.5	143	34.1	.	.	148	32.4	127	38.4	163	28.1	150	32.9
ROLLIN SCHAMFER	180	24.4	229	16.6	.	.	159	29.7	212	18.7	300	9.9	601	0.4
SENARD	181	24.4	175	25.4	.	.	188	24.2	185	23.8	232	17.0	183	25.1
TOPONTO	182	24.0	146	32.7	.	.	163	28.0	178	25.5	156	30.7	165	28.3
ALBANY	183	23.7	195	21.9	.	.	169	26.5	179	24.7	202	21.8	171	27.1
BANTON	184	23.5	182	24.1	.	.	147	32.5	186	23.8	207	20.6	176	26.2
MERCER	185	23.4	202	20.2	.	.	199	22.2	204	19.4	200	21.9	204	20.3
WARRICK	186	23.3	192	22.2	.	.	190	23.9	184	23.9	192	22.9	190	22.9
CLINCH RIVER	187	23.2	187	23.4	.	.	171	26.3	173	26.0	162	28.5	173	26.8
ALMA-MADGETT	188	23.1	194	22.0	.	.	178	25.4	163	28.6	168	27.2	195	22.0
SUTTON	189	22.9	245	14.4	.	.	232	16.7	217	18.6	218	18.5	265	12.2
OSWEGO	190	22.6	80	63.7	.	.	108	46.7	95	55.8	88	62.2	140	35.2
NORTH OMAHA	191	22.6	224	16.8	.	.	.	.	188	23.1	217	18.6	214	18.4
RIVERBEND	192	22.1	230	16.3	.	.	317	9.0	229	16.7	220	18.3	291	9.3
NEW CASTLE	193	22.1	161	27.8	.	.	161	29.1	108	46.9	116	46.1	107	47.7
BAY SHORE	194	22.0	167	26.2	.	.	158	30.3	77	66.6	71	79.2	83	67.6
GRAND TOWER	195	22.0	177	25.1	.	.	146	32.5	193	22.2	145	34.6	148	33.4
BURLINGTON	196	21.9	190	22.7	.	.	194	23.2	201	20.8	191	23.1	187	24.0
PRESQUE ISLE	197	21.4	212	18.2	.	.	214	19.2	129	37.8	277	12.0	220	17.1
TRENTON CHANNEL	198	21.3	172	25.7	.	.	149	31.8	135	34.9	97	55.8	99	55.5
WESTON	199	21.0	189	22.8	.	.	202	21.5	220	16.7	198	22.1	225	16.0
GEORGETOWN	200	21.0	197	21.4	.	.	135	35.4	177	25.8	185	24.7	224	16.1
HUDSON	204	20.1	214	18.0	.	.	183	24.7	208	19.2	193	22.7	182	25.2
PRITCHARD	205	19.9	203	20.2	.	.	222	18.1	235	16.1	175	26.4	178	26.1
JAMES RIVER	207	19.7	222	17.1	.	.	165	28.3	292	9.5	322	8.5	261	12.7
WILL COUNTY	209	19.6	205	19.9	.	.	201	21.9	214	18.7	210	20.3	133	36.9
WATTS BAR	210	19.6	259	13.3	.	.	180	25.4	189	23.0	150	32.7	156	31.1
RIVER ROUGE	211	19.3	193	22.1	.	.	205	11.0	205	19.4	281	11.6	284	10.1
COOPER	214	18.8	191	22.6	.	.	193	23.3	192	22.5	186	23.9	138	35.6
PORT EVERGLADES	215	18.6	168	26.0	.	.	134	35.4	195	21.4	206	20.9	169	27.8
ASHEVILLE	219	17.7	215	17.6	.	.	211	19.6	199	21.0	223	18.1	208	19.1
COLLINS	220	17.7	225	16.7	.	.	110	45.8	279	11.2	376	5.1	1749	0.0
HIGH BRIDGE	221	17.2	276	11.9	.	.	227	17.6	227	16.8	208	20.6	181	25.6
RIVERSIDE	222	17.2	218	17.4	.	.	284	11.7	209	18.9	171	26.9	186	24.4
WAGNER	224	17.1	208	18.9	.	.	216	19.1	198	21.5	209	20.5	206	19.9
MARION	226	16.9	165	26.5	.	.	160	29.6	152	30.3	183	25.0	184	24.5
HUTSONVILLE	230	16.1	254	13.8	.	.	286	11.6	249	14.8	201	21.9	196	21.7
RIVERSIDE	231	15.9	185	23.7	.	.	162	28.9	190	22.7	197	22.2	192	22.4

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EDWARDS	239	14.6	242	15.0	.	.	213	19.3	134	34.5	115	49.0	101	58.6
LAKEROAD	243	14.0	166	26.5	.	.	236	16.3	207	19.2	187	23.9	270	11.6
WILLIAMS	246	13.6	188	22.9	.	.	166	28.0	133	35.6	160	28.9	164	28.6
EDGEWATER	255	12.7	209	18.9	.	.	207	20.2	183	24.5	195	22.5	189	23.5
PORT WENTWORTH	262	12.2	261	12.9	.	.	173	26.1	160	29.1	174	26.5	180	25.8
PORTSMOUTH	267	12.0	210	18.5	.	.	156	30.6	155	29.6	181	25.4	146	33.7
BLACK DOG	268	11.9	252	13.8	.	.	197	22.8	210	18.9	190	23.3	168	27.9
JEFFREY ENERGY CN	271	11.7	373	5.0	.	.	184	24.7	376	5.1	.	.	.	.
TURKEY POINT	274	11.4	220	17.3	.	.	196	23.1	250	14.5	269	13.0	221	16.8
MEADOCK-BANDUSKY	276	11.5	169	26.0	.	.	192	23.5	176	25.9	172	26.8	158	30.5
DES MOINES	278	11.4	291	10.4	.	.	249	15.0	261	13.2	205	21.2	193	22.3
GREEN RIVER	288	11.0	272	12.0	.	.	224	18.0	241	15.5	244	15.7	165	28.4
ECKERT	309	9.7	294	10.2	.	.	341	7.7	242	15.5	212	20.2	198	21.3
LAKE SHORE	311	8.8	285	11.1	.	.	297	10.6	278	11.2	111	50.7	100	55.3
NEWTON	340	7.0	89	57.9	.	.	437	2.5	72	70.8	234	16.5	.	.
PITTSBURG	346	6.3	270	12.2	.	.	182	24.8	244	15.4	227	17.7	254	15.1
MOSS LANDING	361	5.6	296	10.2	.	.	189	24.2	290	9.9	235	16.4	268	11.7
ERICKSON	378	4.7	217	17.5	.	.	228	17.2	256	13.7	196	22.4	188	23.7
ACME	386	4.4	231	16.1	.	.	212	19.3	198	21.1	169	27.1	209	21.0
WILSON	397	3.9	136	36.1	.	.	551	0.0	99	53.5	132	40.0	191	22.9
SAN JUAN	423	3.0	487	1.0	.	.	305	9.9	254	14.0	167	27.2	238	14.9

APPENDIX D

DEFAULT FUEL SULFUR VALUES

Table D-1

DEFAULT OIL SULFUR VALUES USED IN THE ANALYSIS
(Percent)

State	1976	1977	1978	1979	1980
Alabama	0.46	0.51	0.57	0.36	0.36
Alaska	0.96	0.91	0.96	1.02	1.04
Arizona	0.65	0.65	0.66	0.75	0.78
Arkansas	1.33	1.18	1.16	1.25	1.39
California	0.46	0.37	0.32	0.33	0.33
Colorado	0.63	0.67	0.50	0.49	0.54
Connecticut	0.37	0.37	0.39	0.44	0.44
Delaware	0.94	0.94	0.94	1.01	1.01
District of Columbia	0.93	1.00	0.81	0.86	0.87
Florida	1.44	1.50	1.27	1.42	1.49
Georgia	1.20	1.26	1.62	2.13	1.77
Hawaii	1.22	1.25	1.08	1.29	1.12
Idaho	0.96	0.20	0.30	0.22	1.04
Illinois	0.52	0.55	0.53	0.60	0.66
Indiana	0.31	0.34	0.37	0.32	0.30
Iowa	0.34	0.36	0.29	0.06	0.21
Kansas	1.07	0.92	0.99	1.27	0.50
Kentucky	0.43	0.31	0.24	0.39	0.36
Louisiana	0.75	0.77	0.76	0.79	0.84
Maine	2.05	2.23	1.48	1.42	1.34
Maryland	1.28	1.29	1.27	1.29	1.27
Massachusetts	1.02	1.02	1.57	1.70	1.68
Michigan	0.71	0.74	0.70	0.66	0.67
Minnesota	1.49	1.26	1.29	1.36	1.03
Mississippi	2.14	2.19	2.12	2.49	2.61
Missouri	0.85	0.76	0.70	0.87	0.61
Montana	0.02	0.28	0.00	0.01	0.08
Nebraska	0.76	0.86	0.98	0.95	0.84
Nevada	0.75	0.70	0.68	0.63	0.73
New Hampshire	1.83	1.79	1.71	1.82	1.93
New Jersey	0.37	0.43	0.46	0.48	0.46
New Mexico	0.43	0.50	0.48	0.46	0.39
New York	1.06	1.12	1.11	1.28	1.26
North Carolina	0.20	0.22	0.65	0.23	0.23
North Dakota	0.34	0.41	0.23	0.25	0.22
Ohio	0.38	0.59	0.57	0.86	0.54
Oklahoma	0.70	0.55	0.35	0.76	0.18
Oregon	0.10	0.29	0.29	0.30	0.27
Pennsylvania	0.43	0.49	0.54	0.66	0.65
Rhode Island	0.94	0.94	0.88	0.90	0.93
South Carolina	2.04	1.56	1.69	1.93	1.85
South Dakota	0.80	0.58	0.65	0.54	0.35
Tennessee	0.69	0.69	0.69	0.57	0.54

Table D-1 (Continued)

DEFAULT OIL SULFUR VALUES USED IN THE ANALYSIS
(Percent)

State	1976	1977	1978	1979	1980
Texas	0.49	0.44	0.50	0.59	0.51
Utah	0.34	0.38	0.30	0.36	0.35
Vermont	0.11	0.29	0.96	0.32	0.40
Virginia	1.54	1.52	1.57	1.43	1.31
Washington	0.20	0.02	0.03	1.63	1.63
West Virginia	0.10	0.23	0.30	0.38	0.29
Wisconsin	0.40	0.37	0.35	0.48	0.43
Wyoming	0.16	0.30	0.31	0.30	0.30

Table D-2

DEFAULT COAL SULFUR VALUES USED IN THE ANALYSIS
(Percent)

State	1976	1977	1978	1979	1980
Alabama	2.14	2.00	1.86	1.68	1.59
Alaska	2.12	2.01	1.86	1.80	1.68
Arizona	0.48	0.44	0.41	0.43	0.47
Arkansas	2.12	2.01	0.36	0.34	0.38
California	2.12	2.01	1.86	1.80	1.68
Colorado	0.49	0.49	0.46	0.44	0.44
Connecticut	2.12	2.01	1.86	1.80	1.68
Delaware	2.07	2.01	1.80	1.85	1.64
District of Columbia	2.12	2.01	1.86	1.80	1.68
Florida	2.50	2.38	1.95	1.99	2.16
Georgia	1.72	1.69	1.73	1.77	1.82
Hawaii	2.12	2.01	1.86	1.80	1.68
Idaho	2.12	2.01	1.86	1.80	1.68
Illinois	2.39	2.20	2.08	1.96	1.88
Indiana	2.66	2.62	2.59	2.72	2.63
Iowa	1.73	1.59	1.60	1.36	1.18
Kansas	3.19	2.38	1.47	1.39	1.35
Kentucky	3.22	2.91	2.63	2.73	2.43
Louisiana	2.12	2.01	1.86	1.80	0.44
Maine	2.12	2.01	1.86	1.80	1.68
Maryland	1.50	1.51	1.51	1.44	1.63
Massachusetts	2.12	2.01	1.86	2.63	1.16
Michigan	2.19	2.14	1.89	1.65	1.32
Minnesota	1.36	1.21	1.06	1.02	1.05
Mississippi	1.92	2.21	1.91	1.60	1.65
Missouri	3.26	3.09	2.68	2.67	2.66
Montana	0.73	0.73	0.73	0.71	0.76
Nebraska	0.63	0.66	0.72	0.58	0.57
Nevada	0.42	0.44	0.56	0.65	0.55
New Hampshire	2.22	2.33	2.18	2.57	2.55
New Jersey	1.61	1.74	1.67	1.71	1.64
New Mexico	0.67	0.70	0.70	0.73	0.73
New York	1.90	1.81	1.73	1.83	1.85
North Carolina	1.03	1.06	1.08	0.94	0.96
North Dakota	0.60	0.59	0.61	0.63	0.65
Ohio	2.96	2.88	2.73	2.65	2.49
Oklahoma	0.39	0.36	0.36	0.38	0.38
Oregon	2.12	2.01	1.86	0.53	0.35
Pennsylvania	2.20	2.18	2.12	2.09	2.12
Rhode Island	2.12	2.01	1.86	1.80	1.68
South Carolina	1.26	1.33	1.32	1.31	1.41
South Dakota	0.82	0.77	0.75	0.67	0.69
Tennessee	2.82	3.06	2.45	2.27	2.23
Texas	0.58	0.57	0.60	0.61	0.58

Table D-2 (Continued)

DEFAULT COAL SULFUR VALUES USED IN THE ANALYSIS
(Percent)

State	1976	1977	1978	1979	1980
Utah	0.52	0.68	0.55	0.50	0.50
Vermont	2.12	1.53	1.86	1.54	1.68
Virginia	0.85	0.97	0.97	0.87	0.88
Washington	0.53	0.59	0.97	0.87	0.81
West Virginia	1.92	1.94	1.88	1.93	1.81
Wisconsin	2.29	2.39	2.32	2.24	2.06
Wyoming	0.53	0.53	0.51	0.51	0.57

Table D-3

DEFAULT COAL SULFUR VALUES USED IN THE ANALYSIS
(Pounds of SO_2 per 10^6 Btu)

State	1976	1977	1978	1979	1980
Alabama	3.70	3.46	3.15	2.83	2.65
Alaska	3.91	3.74	3.50	3.36	3.15
Arizona	0.91	0.82	0.76	0.81	0.89
Arkansas	3.91	3.74	0.86	0.81	0.89
California	3.91	3.74	3.50	3.36	3.15
Colorado	1.01	0.96	0.91	0.87	0.89
Connecticut	3.91	3.74	3.50	3.36	3.15
Delaware	3.31	3.31	2.90	2.98	2.63
District of Columbia	3.91	3.74	3.50	3.36	3.15
Florida	4.29	4.11	3.31	3.35	3.65
Georgia	2.89	2.85	2.92	2.99	3.06
Hawaii	3.91	3.74	3.50	3.36	3.15
Idaho	3.91	3.74	3.50	3.36	3.15
Illinois	4.66	4.26	4.04	3.80	3.66
Indiana	4.95	4.89	4.86	5.02	4.86
Iowa	3.41	3.18	3.25	2.87	2.53
Kansas	6.26	4.94	3.21	2.98	2.93
Kentucky	5.89	5.29	4.78	4.86	4.24
Louisiana	3.91	3.74	3.50	3.36	1.10
Maine	3.91	3.74	3.50	3.36	3.15
Maryland	2.45	2.47	2.48	2.35	2.64
Massachusetts	3.91	3.74	3.50	3.90	1.73
Michigan	3.70	3.63	3.27	2.79	2.19
Minnesota	3.03	2.73	2.40	2.29	2.37
Mississippi	3.30	3.81	3.20	2.74	2.75
Missouri	6.00	5.65	4.98	4.96	4.99
Montana	1.75	1.73	1.71	1.66	1.79
Nebraska	1.21	1.23	1.40	1.21	1.21
Nevada	0.76	0.80	1.01	1.18	0.99
New Hampshire	3.30	3.49	3.35	3.83	3.80
New Jersey	2.47	2.67	2.55	2.63	2.51
New Mexico	1.49	1.56	1.55	1.64	1.64
New York	3.10	2.99	2.87	2.99	3.00
North Carolina	1.70	1.77	1.79	1.54	1.56
North Dakota	1.83	1.78	1.83	1.87	1.96
Ohio	5.39	5.28	5.01	4.76	4.35
Oklahoma	0.94	0.86	0.84	0.88	0.88
Oregon	3.91	3.74	3.50	1.06	0.85
Pennsylvania	3.66	3.64	3.53	3.47	3.51
Rhode Island	3.91	3.74	3.50	3.36	3.15
South Carolina	2.07	2.23	2.18	2.13	2.27
South Dakota	2.57	2.45	2.40	2.11	2.20
Tennessee	5.03	5.52	4.33	3.95	3.84

Table D-3 (Continued)

DEFAULT COAL SULFUR VALUES USED IN THE ANALYSIS
(Pounds of SO_2 per 10^6 Btu)

State	1976	1977	1978	1979	1980
Texas	1.76	1.62	1.70	1.69	1.57
Utah	0.91	1.16	0.94	0.86	0.87
Vermont	3.91	2.38	3.50	2.38	3.15
Virginia	1.39	1.59	1.59	1.40	1.41
Washington	1.31	1.46	2.40	2.15	2.00
West Virginia	3.27	3.33	3.20	3.23	2.98
Wisconsin	4.29	4.52	4.41	4.28	4.00
Wyoming	1.22	1.19	1.16	1.17	1.30
UNITED STATES	3.91	3.74	3.50	3.36	3.15

APPENDIX E

SULFUR DIOXIDE EMISSIONS OF ALL PLANTS EMITTING OVER 100 TONS PER YEAR

ALL PLANTS EMITTING OVER 100 TONS PER YEAR
1980 SO2 EMISSIONS IN 1000 TONS PER YEAR

STATE=ALABAMA

PLANT	1980 SO2
BARRY	44.1
COLBERT	125.9
GADSDEN	11.1
GASTON	169.1
GORGAS 2 AND 3	84.3
GREENE	27.6
JAMES MILLER	9.9
MC WILLIAMS	0.4
TOMBIGBEE	3.3
WIDOWS CREEK	67.4

STATE=ALASKA

PLANT	1980 SO2
BETHEL	0.1
CHENA	4.0
CORDOVA	0.1
GLENNALLEN	0.1
HEALY	4.7
KODIAK	0.3
NORTH POLE	1.1
VALDEZ N	0.2

STATE=ARIZONA

PLANT	1980 SO2
AGUA FRIA	0.9
APACHE	5.9
CHOLLA	3.5
CORONADO	11.3
IRVINGTON	0.9
NAVAJO	63.3
OCOTILLO	0.5
PHOENIX	0.2
SAGUARO	0.6
SANTAN (GT)	0.1
YUMA AXIS	0.2

ALL PLANTS EMITTING OVER 100 TONS PER YEAR
1980 SO2 EMISSIONS IN 1000 TONS PER YEAR

STATE=ARKANSAS

PLANT	1980 SO2
BAILEY	1.1
BLYTHEVILLE (GT)	0.4
COUCH	0.3
FLINT CREEK	7.9
LAKE CATHERINE	2.1
LYNCH	0.2
MCCLELLAN	2.8
MOSES	1.9
RITCHIE	7.2
WHITEBLUFF	2.7

STATE=CALIFORNIA

PLANT	1980 SO2
ALAMITOS	7.1
AVON	0.1
BROADWAY	0.1
CONTRA COSTA	4.8
COOL WATER	5.1
EL CENTRO	0.5
EL SEGUNDO	2.8
ENCINA	9.5
ETIWANDA	2.8
GLENDALE	0.2
HARBOR	0.2
HAYNES	4.5
HUMBOLDT BAY	1.0
HUNTERS POINT	1.3
HUNTINGTON BEACH	1.8
KERN	1.6
LONG BEACH	0.4
MAGNOLIA	0.3
MAGNOLIA-OLIVE	0.6
MANDALAY	2.2
MARTINEZ	0.9
MORRO BAY	4.8
MOSS LANDING	5.6
N ISLAND (GT)	0.1
OAKLAND	0.5
ORMOND BEACH	6.5
PITTSBURG	6.3
POTRERO	1.1
REDONDO	0.6
SCATTERGOOD	0.5
SOUTH BAY	2.9
VALLEY	0.8

ALL PLANTS EMITTING OVER 100 TONS PER YEAR
1980 SO2 EMISSIONS IN 1000 TONS PER YEAR

STATE=COLORADO

PLANT	1980 SO2
ALAMOSA (GTS)	0.2
ARAPHOE	8.8
BULLOCK	0.3
CAMEO	1.8
CHEROKEE	11.4
CLARK	1.7
COMANCHE	14.8
CRAIG	6.6
DRAKE	8.1
FT LUPTON (GT)	0.1
FT ST VRAIN	0.1
HAYDEN	13.5
NIXON	4.1
NUCLA	1.7
VALMONT	3.6
ZUNI	0.3

STATE=CONNECTICUT

PLANT	1980 SO2
BRIDGEPORT HARBOR	7.1
COS COB (GT)	0.1
DEVON	3.7
ENGLISH	0.1
MIDDLETOWN	7.8
MONTVILLE	3.3
NEW HAVEN HBR	4.5
NORWALK HARBOR	5.0
SOUTH MEADOW	0.2

STATE=DELAWARE

PLANT	1980 SO2
CHRISTIANA (GT)	0.1
DELAWARE CITY	5.0
EDGEMOOR	15.3
INDIAN RIVER	28.0
MCKEE RUN	4.0

STATE=DISTRICT OF COLUMBIA

PLANT	1980 SO2
BENNING	3.5
BUZZARD POINT	1.1

ALL PLANTS EMITTING OVER 100 TONS PER YEAR
1980 SO2 EMISSIONS IN 1000 TONS PER YEAR

STATE=FLORIDA

PLANT	1980 SO2
ANCLOTE	57.0
AVON PARK	2.5
BARTOW	23.5
BAYBORO (GT)	0.9
BIG BEND	153.2
CAPE CANAVERAL	31.3
CRIST	76.3
CRYSTAL RIVER	72.6
DEBARY	0.7
DEERHAVEN	1.3
FORT MYERS	36.5
G W IVEY	0.2
GANNON	41.9
HIGGINS	7.4
HOOKERS POINT	2.6
HOPKINS	5.6
INDIAN RIVER	12.3
INTERCESSION (GT)	2.2
JR KELLY	0.2
KENNEDY	5.8
KEY WEST	1.8
LARSEN MEM	0.9
LAUDERDALE	3.6
MANATEE	29.8
MARATHON	0.1
MARTIN	0.7
NORTHSIDE	28.6
PLANT 3-MCINTOSH	4.3
PORT EVERGLADES	18.6
PURDOM	2.0
PUTNAM	2.9
RIVIERA	6.0
SANFORD	31.1
SCHOLTZ	9.4
SMITH	19.2
SOUTHSIDE	7.8
STOCK ISLAND	3.5
SUWANNEE	1.9
TOM G SMITH	0.6
TURKEY POINT	11.6
TURNER	6.2
VERO BEACH	1.0

ALL PLANTS EMITTING OVER 100 TONS PER YEAR
1980 SO2 EMISSIONS IN 1000 TONS PER YEAR

STATE=GEORGIA

PLANT	1980 SO2
ARKWRIGHT	11.7
BOWEN	248.1
CRISP	0.2
EFFINGHAM	2.7
HAMMOND	47.4
HARLLEE BRANCH	55.1
MCDONOUGH	31.7
MCMANUS	0.4
MITCHELL	10.4
PORT WENTWORTH	12.2
VOGTLE (GT)	0.3
WANSLEY	209.8
YATES	106.6

STATE=HAWAII

PLANT	1980 SO2
HILL	2.7
HONOLULU	1.0
KAHE	25.9
KAHULUI	2.2
MAALAEA	1.2
MOLOKAI	0.2
PORT ALLEN	1.4
SHIPMAN	0.3
WAIAU	6.6

STATE=ILLINOIS

PLANT	1980 SO2
BALDWIN	259.3
BLOOM (GT)	0.2
CALUMET (GT)	0.2
COFFEEN	137.3
COLLINS	17.7
CRAWFORD	11.7
DALLMAN	45.6
DUCK CREEK	14.5
EDWARDS	14.6
ELEC JUNCTION(GT)	0.2
FISK	7.5
GRAND TOWER	22.0
HAVANA	7.4
HENNEPIN	38.5
HUTSONVILLE	16.1
JOLIET	28.6
JOPPA	100.1
KINCAID	205.5
LAKESIDE	11.8

ALL PLANTS EMITTING OVER 100 TONS PER YEAR
1980 SO2 EMISSIONS IN 1000 TONS PER YEAR

STATE=ILLINOIS

PLANT	1980 SO2
MARION	16.9
MEREDOSIA	48.1
MT CARMEL	0.6
NEWTON	7.0
PEARL (GTS)	4.5
POWERTON	24.8
RIDGELAND	10.4
S MAIN ST	1.8
SABROOKE	0.3
VERMILION	27.3
WALLACE	1.3
WAUKEGAN	13.4
WILL COUNTY	19.6
WOOD RIVER	10.6

STATE=INDIANA

PLANT	1980 SO2
A B BROWN	5.7
BAILLY	48.9
BREED	71.0
CAYUGA	115.9
CLIFTY CREEK	288.2
CRAWFORDSVILLE	3.6
CULLEY	63.7
EDWARDSPORT	10.5
FRANK E RATTS	49.8
GALLAGHER	59.5
GIBSON STATION	305.6
JASPER	2.2
LOGANSPORT	1.8
MICHIGAN CITY	75.4
MITCHELL	18.3
NOBLESVILLE	5.1
PERRY	3.5
PERRY W	0.6
PERU	3.9
PETERSBURG	108.5
PRITCHARD	19.9
ROLLIN SCHAHFER	24.4
STATE LINE	9.3
STOUT	50.1
TANNERS CREEK	94.9
WABASH RIVER	66.0
WARRICK	23.3
WHITEWATER	10.0

ALL PLANTS EMITTING OVER 100 TONS PER YEAR
1980 SO2 EMISSIONS IN 1000 TONS PER YEAR

STATE=IOWA

PLANT	1980 SO2
AMES	3.9
BOONE	0.3
BURLINGTON	21.9
CEDAR FALLS	0.8
CENT HEAT	1.3
COUNCIL BLUFFS	13.2
DES MOINES	11.4
DUBUQUE	8.2
FAIR	5.5
HUMBOLDT	0.4
KAPP	32.3
LANSING	8.9
MAYNARD	0.3
MUSCATINE	15.2
NEAL	44.3
PELLA	3.9
POWER PLT	1.4
PRAIRE CREEK 1-4	11.4
RIVERSIDE	15.9
SUTHERLAND	24.7
WISDOM	2.1
6TH ST	3.5

STATE=KANSAS

PLANT	1980 SO2
EVANS	0.1
GILL	0.2
HUTCHINSON	0.7
JEFFREY ENERGY CN	11.7
KAW	15.1
LA CYGNE	78.0
LAWRENCE	5.8
MULLERGREN	0.1
QUINDARO	25.4
RIVERTON	7.1
TECUMSEH	4.9

STATE=KENTUCKY

PLANT	1980 SO2
BIG SANDY	57.9
BROWN	53.2
CANE RUN	35.6
COLEMAN	68.3
COOPER	18.8
DALE	5.3
GHENT	85.4
GREEN RIVER	11.0

ALL PLANTS EMITTING OVER 100 TONS PER YEAR
1980 SO2 EMISSIONS IN 1000 TONS PER YEAR

STATE=KENTUCKY

PLANT	1980 SO2
HENDERSON	2.0
HENDERSON II	50.2
MILL CREEK	94.1
PADDYS RUN	1.0
PARADISE	342.7
PINEVILLE	0.5
R D GREEN	13.5
REID	12.3
SHAWNEE	96.6
SMITH	44.0
SPURLOCK	14.2
TYRONE	1.1

STATE=LOUISIANA

PLANT	1980 SO2
LITTLE GYPSY	1.2
MICHOUD	2.0
NELSON	0.8
NINE MILE	3.5
PATERSON	0.4
RODEMACHER	0.6
WATERFORD	12.4
WILLOW GLEN	3.7

STATE=MAINE

PLANT	1980 SO2
CARIBOU	0.1
GRAHAM	1.3
MASON	2.6
WYMAN	12.1

STATE=MARYLAND

PLANT	1980 SO2
CHALK	50.4
CRANE	10.3
DICKERSON	35.6
EASTON (IC)	0.3
GOULD ST	1.4
MORGANTOWN	92.0
PERRYMAN (GT)	0.5
RIVERSIDE	2.6
SMITH	6.1
VIENNA	5.6
WAGNER	17.1

ALL PLANTS EMITTING OVER 100 TONS PER YEAR
1980 SO2 EMISSIONS IN 1000 TONS PER YEAR

STATE=MARYLAND

PLANT	1980 SO2
WESTPORT	1.2

STATE=MASSACHUSETTS

PLANT	1980 SO2
BLACKSTONE	0.1
BRAYTON	83.2
CANAL	70.6
CANNON	0.5
CLEARY	3.2
GLOUCESTER (IC)	0.1
KENDALL SQUARE	0.3
MOUNT TOM	11.0
MYSTIC	25.6
NANTUCKET	0.3
NEW BOSTON	20.2
POTTER	0.6
SALEM HARBOR	38.0
SOMERSET	12.1
WEST SPRINGFIELD	9.1

STATE=MICHIGAN

PLANT	1980 SO2
ADVANCE	4.0
BAYSIDE	0.5
CAMPBELL	65.5
CITY ISLAND	1.7
COBB-SANDUSKY SG	48.5
COLDWATER	0.8
CONNERS CREEK	5.3
DELRAY	0.4
ECKERT	9.7
ERICKSON	4.7
ESCANABA	1.8
GLADSTONE	0.1
GREENWOOD	6.3
HARBOR BEACH	2.4
HILLSDALE	0.1
J H WARDEN	1.8
JAMES DE YOUNG	3.9
KARN-WEADOCK	32.2
MARYSVILLE	3.5
MISTERSKY	1.9
MONROE	233.9
MORROW	0.1
OTTAWA	0.5
PENNSALT	0.3
PLANT NO.65	0.9

ALL PLANTS EMITTING OVER 100 TONS PER YEAR
1980 SO2 EMISSIONS IN 1000 TONS PER YEAR

STATE=MICHIGAN

PLANT	1980 SO2
PORT HURON	0.1
PRESQUE ISLE	21.4
RIVER ROUGE	19.3
SHIRAS	2.8
ST CLAIR	44.4
TRENTON CHANNEL	21.3
WEADOCK-SANDUSKY	11.5
WHITING	12.5
WYANDOTTE	0.7

STATE=MINNESOTA

PLANT	1980 SO2
AURORA-SYL LASKIN	3.5
BLACK DOG	11.9
BOSWELL	32.0
DOWNTOWN-4TH AVE	0.6
ELK RIVER	0.3
FAIRMONT	0.7
FOX LAKE	0.8
HIBBARD	1.8
HIBBING	2.2
HIGH BRIDGE	17.2
HOOT LAKE	6.6
KING	34.7
MINN VALLEY	0.8
MOORHEAD	0.7
NEW ULM	1.6
ORTONVILLE	1.9
RED WING	0.3
RIVERSIDE	17.2
SHERBURNE COUNTY	32.8
SILVER LAKE	7.2
SLEEPY EYE	0.2
VIRGINIA	0.9
WILLMAR	0.9
WILMARTH	0.5

STATE=MISSISSIPPI

PLANT	1980 SO2
DELTA	0.6
EATON	0.3
GERALD ANDRUS	39.5
HENDERSON STA	2.4
JACKSON CT-DANIEL	9.5
R D MORROW	6.1
WATSON	65.9
WILSON	3.9

ALL PLANTS EMITTING OVER 100 TONS PER YEAR
1980 SO2 EMISSIONS IN 1000 TONS PER YEAR

STATE=MISSISSIPPI

PLANT	1980 SO2
WRIGHT	0.8

STATE=MISSOURI

PLANT	1980 SO2
ASBURY	65.0
ASHLEY	0.2
BLUE VALLEY	17.8
CHAMOIS	10.3
CHILLICOTHE	0.9
COLEMAN	0.8
COLUMBIA	6.0
GRAND AVE	2.4
GREENWOOD ENERGY	0.2
HAWTHORNE	45.4
HILL	121.6
IATAN	12.0
JAMES RIVER	19.7
LABADIE	237.2
LAKEROAD	14.0
MADRID	198.9
MARSHALL	0.2
MERAMEC	29.3
MONTROSE	162.0
NORTHEAST	0.3
RUSH ISLAND	51.9
SIBLEY	40.4
SIOUX	97.2
SOUTHWEST	6.5

STATE=MONTANA

PLANT	1980 SO2
COLSTRIP NO.1	13.4
CORETTE	7.5
LEWIS-CLARK	2.5

STATE=NEBRASKA

PLANT	1980 SO2
BURDICK	0.2
CANADAY	0.3
GERALD GENTLEMAN	9.1
KRAMER	1.8
NEBRASKA CITY	8.6
NORTH DENVER	0.1
NORTH OMAHA	22.6

ALL PLANTS EMITTING OVER 100 TONS PER YEAR
1980 SO2 EMISSIONS IN 1000 TONS PER YEAR

STATE=NEBRASKA

PLANT	1980 SO2
SHELDON	5.4
WRIGHT	1.3

STATE=NEVADA

PLANT	1980 SO2
FORT CHURCHILL	3.5
GARDNER	0.3
MOHAVE	33.1
TRACY	2.5

STATE=NEW HAMPSHIRE

PLANT	1980 SO2
DANIEL ST	0.2
MANCHESTER	0.3
MERRIMACK	52.3
NEWINGTON STATION	20.2
SCHILLER	7.5

STATE=NEW JERSEY

PLANT	1980 SO2
BERGEN	1.0
BURLINGTON	2.1
CAROLL CORNR (GT)	0.3
CEDAR STA (GT)	0.5
DEEPWATER	3.0
ENGLAND	41.3
ESSEX	0.8
GILBERT	1.8
GLEN GARDNER (GT)	0.5
H M DOWN	4.6
HUDSON	20.1
KEARNY	2.0
LINDEN	2.9
MERCER	23.4
MICKELTON (GT)	0.3
MIDDLE STA (GT)	0.4
MISSOURI AVENUE	0.3
SAYREVILLE	1.7
SEWAREN	2.3
WERNER	1.0

ALL PLANTS EMITTING OVER 100 TONS PER YEAR
1980 SO2 EMISSIONS IN 1000 TONS PER YEAR

STATE=NEW MEXICO

PLANT	1980 SO2
FOUR CORNERS	80.7
LORDSBURG	0.3
RATON	0.3
RIO GRANDE	0.3
SAN JUAN	3.0

STATE=NEW YORK

PLANT	1980 SO2
ALBANY	23.7
ARTHUR KILL	8.4
ASTORIA	3.3
ASTORIA 6	3.8
BARRETT	0.6
BOWLINE	9.1
DANSKAMMER	7.5
DUNKIRK	52.0
EAST RIVER	1.4
GLENWOOD	0.6
GOUDEY	14.0
GOWANUS (GT)	0.5
GREENIDGE	24.9
HICKLING	5.4
HOLBROOK (GT)	0.6
HUNTLEY	50.6
JENNISON	5.1
LOVETT	0.6
MILLIKEN	28.9
NARROWS BAY (GT)	0.1
NORTHPORT	77.6
OSWEGO	22.6
PORT JEFFERSON	25.6
RAVENSWOOD	11.2
ROCHESTER 3	12.1
ROCHESTER 7	27.7
ROCKVILLE C	0.1
ROSETON	52.3
SAMUEL A CARLSON	7.1
WATERSIDE	1.3
59TH ST	0.8
74TH ST	0.5

ALL PLANTS EMITTING OVER 100 TONS PER YEAR
1980 SO2 EMISSIONS IN 1000 TONS PER YEAR

STATE=NORTH CAROLINA

PLANT	1980 SO2
ALLEN	38.0
ASHEVILLE	17.7
BELEWS CREEK	86.6
BUCK	13.2
CAPE FEAR	13.3
CHAPEL HILL	1.0
CLIFFSIDE	32.5
DAN RIVER	9.5
KITTY HAWK (GT)	0.1
LEE	17.2
MARSHALL	85.1
RIVERBEND	22.1
ROXBORO	70.5
SUTTON	22.8
WEATHERSPOON	5.6

STATE=NORTH DAKOTA

PLANT	1980 SO2
BEULAH	0.4
COAL CREEK	4.4
HESKETT	5.9
LELAND OLDS	34.3
STANTON	8.3
WM J NEAL	2.7
YOUNG	26.4

STATE=OHIO

PLANT	1980 SO2
ACME	4.4
ASHTABULA	68.5
AVON LAKE	89.5
BAY SHORE	22.0
BECKJORD	84.4
BURGER	84.7
CARDINAL	126.0
CONESVILLE	200.8
DOVER	2.2
E PALESTINE	0.1
EASTLAKE	155.0
EDGEWATER	12.7
GAVIN	376.4
GORGE STEAM	11.8
HAMILTON	2.7
HUTCHINGS	7.8
KYGER CREEK	202.3
LAKE SHORE	8.8
MAD RIVER	1.6

ALL PLANTS EMITTING OVER 100 TONS PER YEAR
1980 SO2 EMISSIONS IN 1000 TONS PER YEAR

STATE=OHIO

PLANT	1980 SO2
MIAMI FORT	89.5
MUSKINGUM	244.0
NILES	24.5
NORWALK	0.1
PAINESVILLE	4.3
PICWAY	19.0
PIQUA	4.4
POSTON	31.5
SAMMIS	137.0
SHELBY	2.3
ST MARYS	1.5
STUART	112.8
TAIT	6.0
TORONTO	24.0
VINE STREET	7.7
W LORAIN (GT)	0.8
WALNUT (GT)	0.1

STATE=OKLAHOMA

PLANT	1980 SO2
MUSKOGEE	15.4
NORTHEASTERN	13.8
SOONER	8.3

STATE=OREGON

PLANT	1980 SO2
BEAVER (GT)	0.2
BOARDMAN	3.0

STATE=PENNSYLVANIA

PLANT	1980 SO2
ARMSTRONG	32.2
BRUCE MANSFIELD	56.6
BRUNNER ISLAND	139.0
BRUNOT IS (GT)	1.0
CHESTER	0.3
CHESWICK	40.0
CONEMAUGH	205.2
CROMBY	14.2
CROYDON (GT)	1.4
DELAWARE	1.6
EDDYSTONE	32.4
ELRAMA	11.1
FRONT ST	10.8

ALL PLANTS EMITTING OVER 100 TONS PER YEAR
1980 SO2 EMISSIONS IN 1000 TONS PER YEAR

STATE=PENNSYLVANIA

PLANT	1980 SO2
HATFIELD	171.2
HOLTWOOD	10.5
HOMER CITY	169.1
HUNLOCK CREEK	2.8
HUNTERSTOWN (GT)	0.1
KEYSTONE	142.3
MARTINS CREEK	60.3
MITCHELL	24.6
MONTOUR	109.5
MOSER (GT)	0.1
NEW CASTLE	22.1
PEACHBOTTOM	0.1
PHILLIPS	8.1
PORTLAND	32.2
RICHMOND	1.6
SCHUYLKILL	1.3
SEWARD	24.4
SHAWVILLE	64.7
SOUTHWARK	1.2
SPRINGDALE	0.1
ST COLLEGE	0.2
SUNBURY	39.7
TITUS	17.0
WARREN	11.6
WILLIAMSBURG	4.9

STATE=RHODE ISLAND

PLANT	1980 SO2
MANCHESTER ST	2.1
SOUTH ST	3.0

STATE=SOUTH CAROLINA

PLANT	1980 SO2
CANADYS	30.7
DARLINGTON (GT)	1.4
GEORGETOWN	21.0
GRAINGER	11.1
HAGOOD	0.2
HILTON HEAD (GT)	0.1
JEFFERIES	27.2
LEE	14.7
MCMEEKIN	19.6
ROBINSON	12.2
URQUHART	19.8
WATEREE	41.3
WILLIAMS	13.6

ALL PLANTS EMITTING OVER 100 TONS PER YEAR
1980 SO2 EMISSIONS IN 1000 TONS PER YEAR

STATE=SOUTH DAKOTA

PLANT	1980 SO2
BEN FRENCH	0.7
BIG STONE	26.8
KIRK	1.1

STATE=TENNESSEE

PLANT	1980 SO2
ALLEN	73.9
BULL RUN	41.0
CUMBERLAND	356.8
GALLATIN	137.1
JOHNSONVILLE	135.3
KINGSTON	88.6
SEVIER	81.4
WATTS BAR	19.6

STATE=TEXAS

PLANT	1980 SO2
BIG BROWN	51.3
CEDAR BAYOU	0.6
COLETO CREEK	4.2
GREEN BAYOU	0.5
HARRINGTON	20.9
J T DEELY	35.8
MARTIN LAKE	43.9
MONTICELLO	68.2
NEWMAN	0.2
PARISH	41.1
ROBINSON	0.2
S SEYMOUR-FAYETTE	18.5
WELSH STATION	16.2
WHARTON	0.2

STATE=UTAH

PLANT	1980 SO2
CARBON	3.7
EMERY-HUNTER	0.7
GADSBY	4.1
HALE	0.9
HUNTINGTON	12.7

ALL PLANTS EMITTING OVER 100 TONS PER YEAR
1980 SO2 EMISSIONS IN 1000 TONS PER YEAR

STATE=VERMONT

PLANT	1980 SO2
MORAN	0.4

STATE=VIRGINIA

PLANT	1980 SO2
BAYVIEW V	0.1
BREMO BLUFF	10.6
CHESTERFIELD	31.2
CLINCH RIVER	23.2
GLEN LYN	11.3
LOWMOOR (GT)	0.3
NNSY	1.1
NORFOLK N B	1.4
NORTHERN NECK(GT)	0.2
PORTSMOUTH	12.0
POSSUM POINT	28.6
POTOMAC RIVER	15.1
YORKTOWN	28.3

STATE=WASHINGTON

PLANT	1980 SO2
CENTRALIA	68.3
SHUFFLETON	1.1

STATE=WEST VIRGINIA

PLANT	1980 SO2
ALBRIGHT	25.7
AMOS	105.1
FT MARTIN	95.1
HARRISON	215.0
KAMMER	149.1
KANAWHA RIVER	16.8
MITCHELL	171.3
MOUNT STORM	91.7
MOUNTAINEER	11.4
PLEASANTS	7.1
RIVESVILLE	7.8
SPORN	40.5
WILLOW ISLAND	7.7

ALL PLANTS EMITTING OVER 100 TONS PER YEAR
1980 SO2 EMISSIONS IN 1000 TONS PER YEAR

STATE=WISCONSIN

PLANT	1980 SO2
ALMA-MADGETT	23.1
BAY FRONT	3.3
BLACKHAWK	1.8
BLOUNT	7.9
CHARTER ST	0.2
COLUMBIA	35.0
EDGEWATER	58.0
GENOA NO.3	37.5
GERMANTOWN	0.6
MANITOWOC	1.0
MENASHA	1.1
NELSON DEWEY	30.7
OAK CREEK	45.9
PLEASANT PRAIRIE	2.2
PORT WASHINGTON	46.1
PULLIAM	40.4
RICHLND CTR	0.9
ROCK RIVER	13.6
S OAK CREEK	75.7
STONEMAN	4.5
VALLEY	32.8
WESTON	21.0
WHEATON (GT)	0.1
WILDWOOD	1.8
WINSLOW	0.4

STATE=WYOMING

PLANT	1980 SO2
JIM BRIDGER	39.3
JOHNSTON	27.3
LARAMIE RIVER	3.2
NAUGHTON	32.1
NEIL SIMPSON	1.0
OSAGE	1.6
WYODAK	16.3